



Cisco Wide Area Application Services (WAAS)

Technical Overview

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Agenda

■ Enterprise Application Delivery Challenges

- Introducing Cisco Wide Area Application Services
- Cisco WAAS Product Architecture
- Application Specific Acceleration
- WAAS Express
- Virtual WAAS
- Data Replication Acceleration
- Network-embedded virtualization
- Remote Access Optimization with WAAS Mobile
- Management and WAE Platforms
- WAAS Installation steps
- Summary
- Q&A



Focus of WAN Optimization Today



Centralization

- Centralize IT while maintaining SLAs
- Virtualized branch services
- Emerging cloud computing

- Consolidation
- Application Acceleration
- Productivity

Faster Applications

- User Productivity
- Remote/mobile users
- Improved DR

WAN Optimization

- Bandwidth optimization
- Latency mitigation

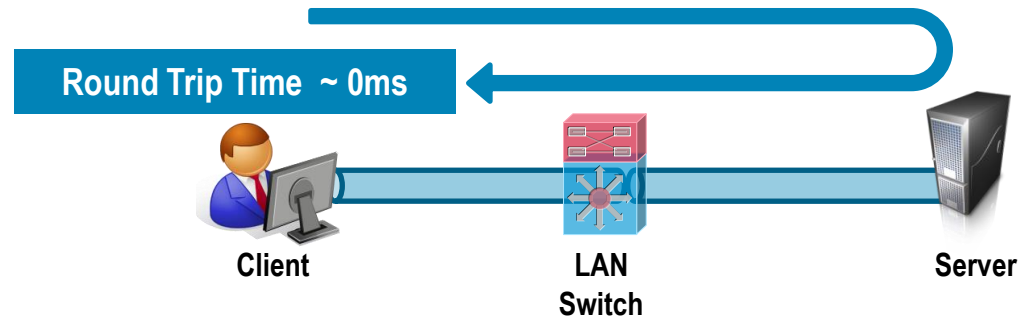
Application Delivery Challenges

- Applications perform well in LAN

High bandwidth

Low latency

Reliability



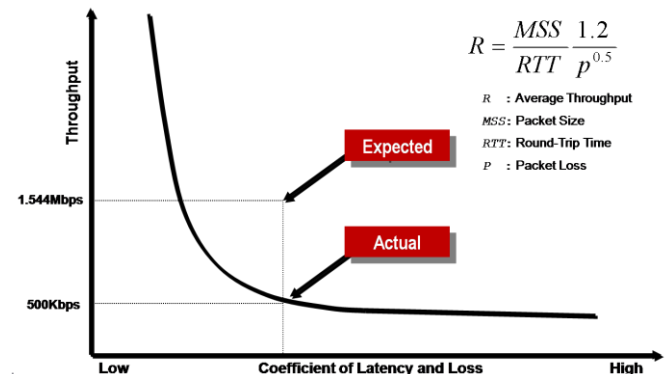
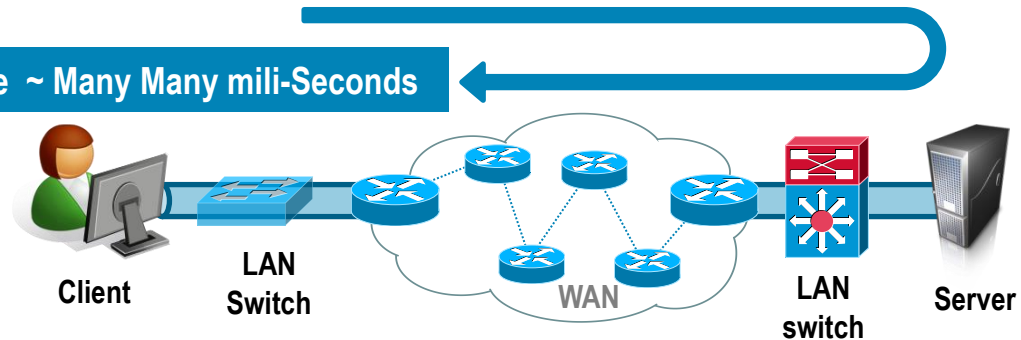
- Applications perform poorly in WAN

Already congested

Low bandwidth

Latency

Packet Loss



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WAAS Solution Benefits

Enhance User Productivity



Application acceleration

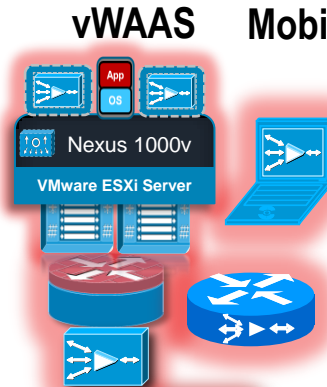
Minimize Branch IT Costs



Branch IT consolidation
WAN bandwidth optimization

Module

Mobile



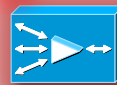
IOS

Confident Migration to Cloud



Public and Private Cloud Acceleration

Appliance

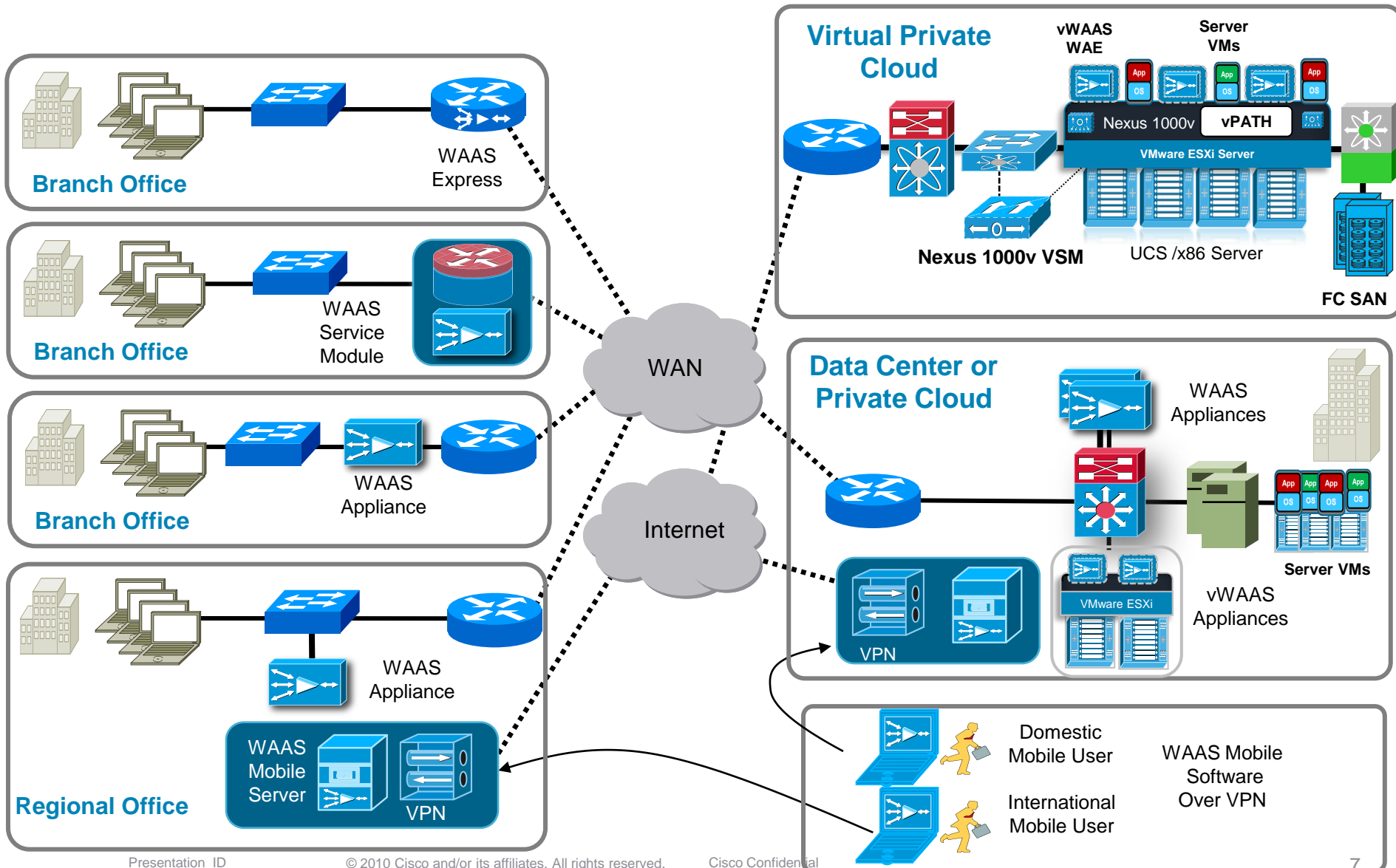


Increase Agility and Flexibility



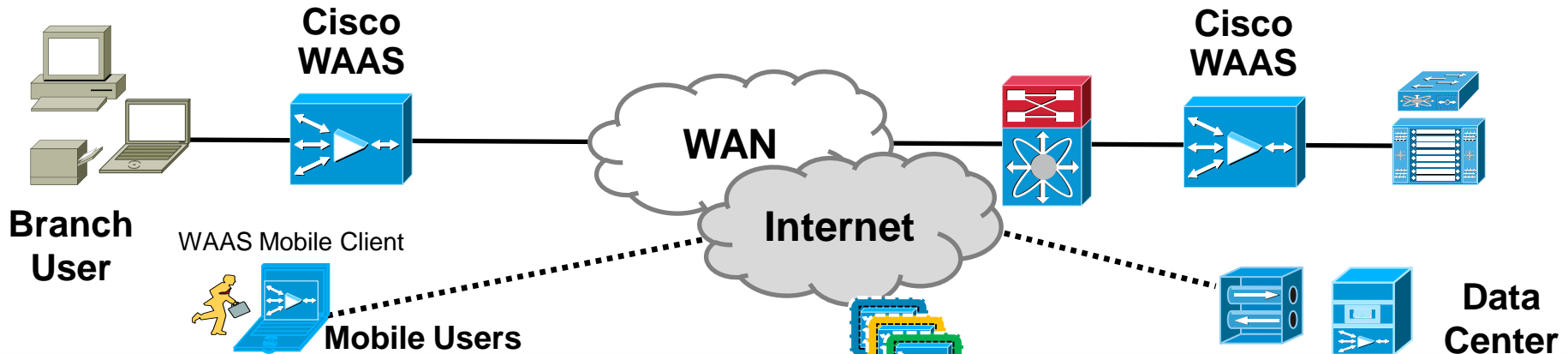
Best mix of centralized and distributed IT

Cisco WAAS: WAN optimization solution



Cisco WAAS Solution Elements

Flexible Deployment Options



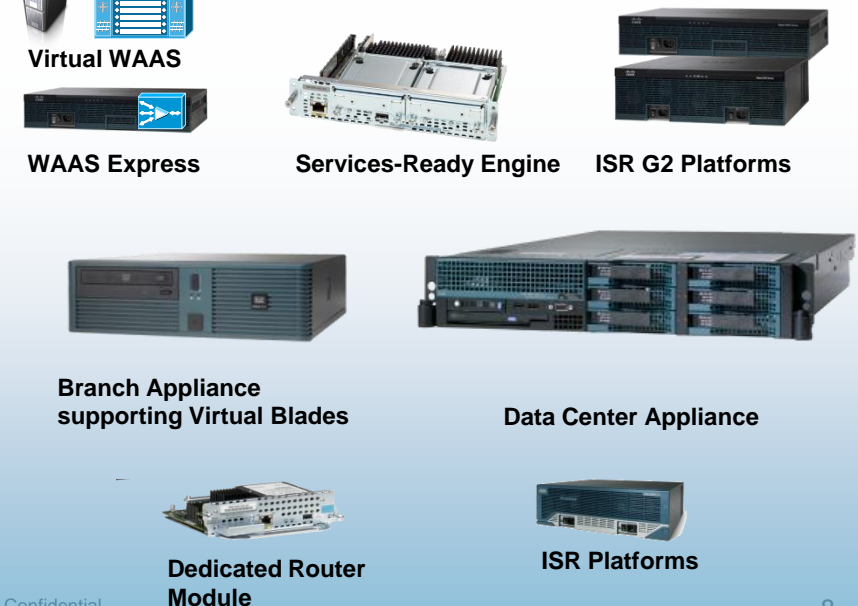
Software Solutions

- WAAS for Cisco ISR G2 Services-Ready Engine
 - WAAS On-demand for IT agility
- **vWAAS**: Virtualized WAAS
- **WAAS Express**: IOS Integrated software based WAN Optimization
- WAAS Mobile Software
 - Optimization for mobile and micro-office users

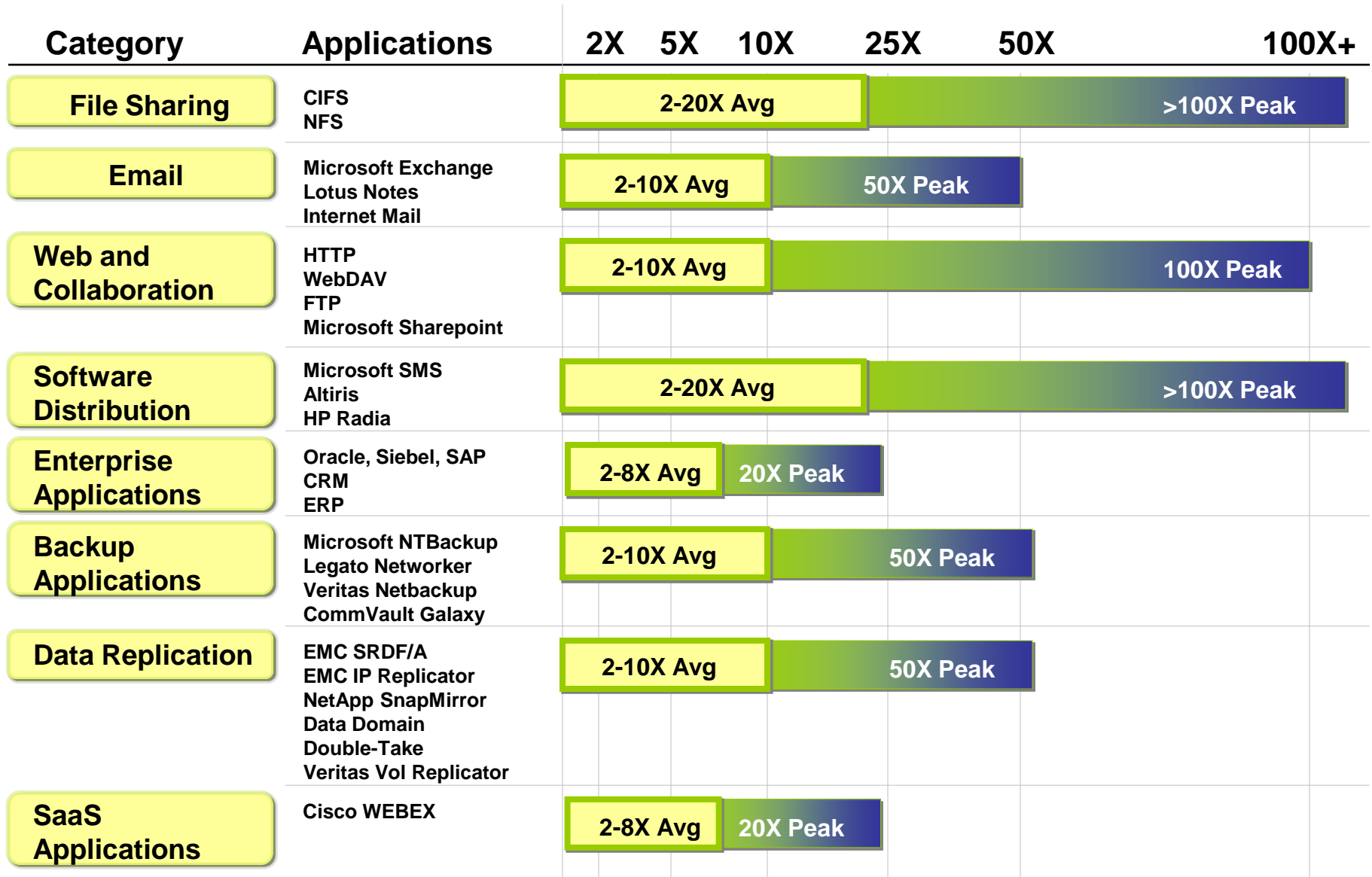
Full appliance portfolio

- Virtual blade support for branches
- Scalable data center platforms

Dedicated router modules



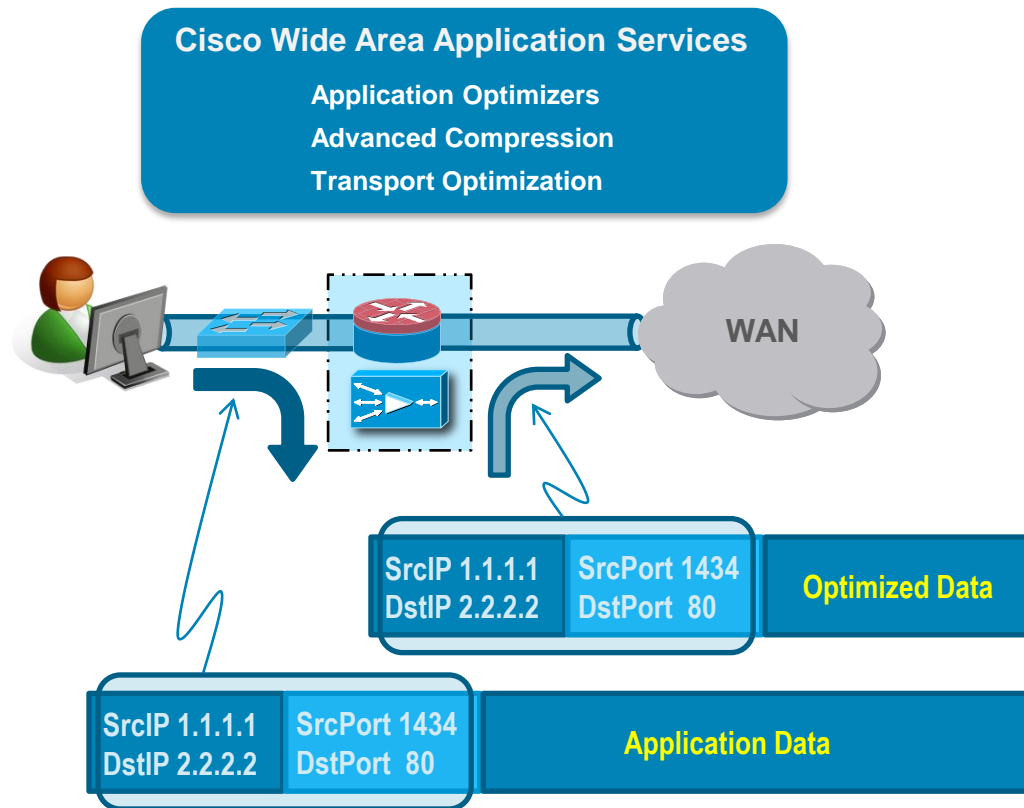
Application Performance Improvements



Seamless and Transparent Integration

- Compliance with critical network services
- Industry's only holistic and secure optimization, visibility, and control solution
- Quality of Service (QoS)
- Network Management
- Security
- Optimized Routing

- **Quality of Service (QoS)**
Classification, NBAR, marking
Policing, shaping, queuing, WRED
LFI, header compression
- **Network Management**
NAM, PVM, NetFlow
NetQoS, IP SLA
- **Optimized Routing**
Network Path Affinity (NPA)
Optimized Edge Routing, PBR

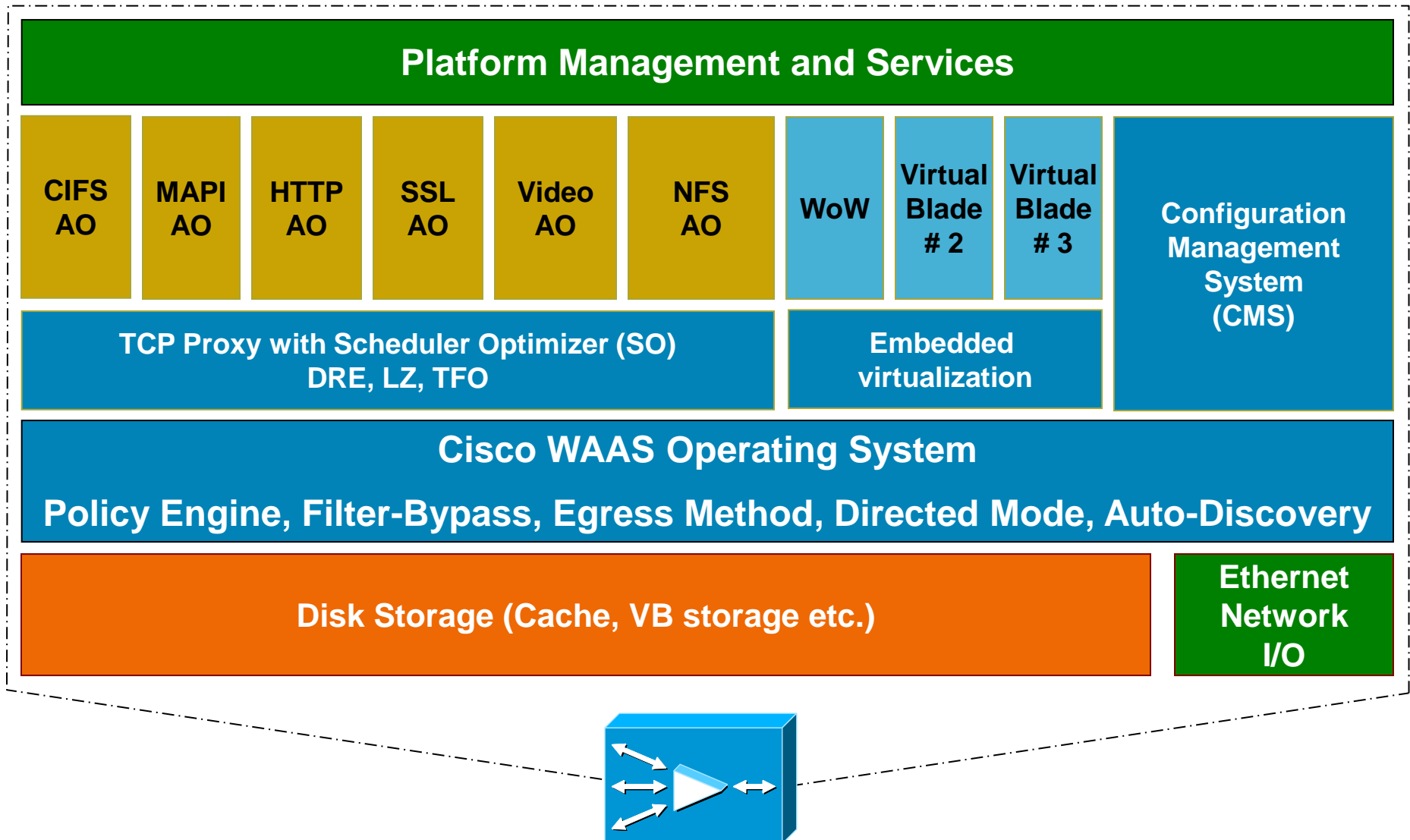


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Cisco WAAS Architecture



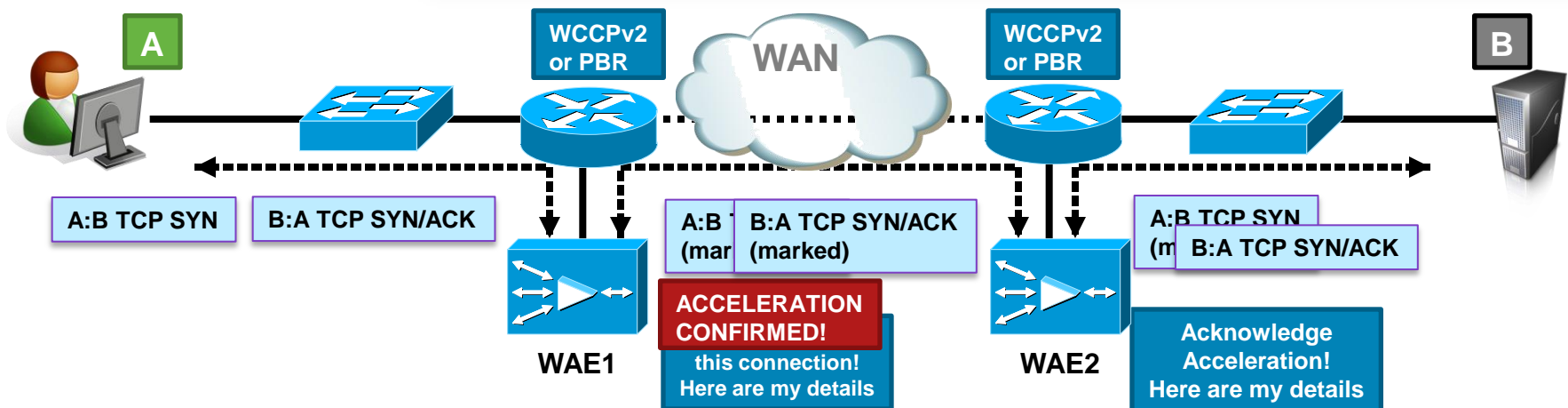
Cisco WAAS Auto-Discovery

Solutions

- Devices automatically discover one another
- Devices automatically negotiate optimization capabilities

Benefits

- Eliminates need for complex overlay networks with tunnels
- And as the result reduces additional efforts associated with management, security and monitoring



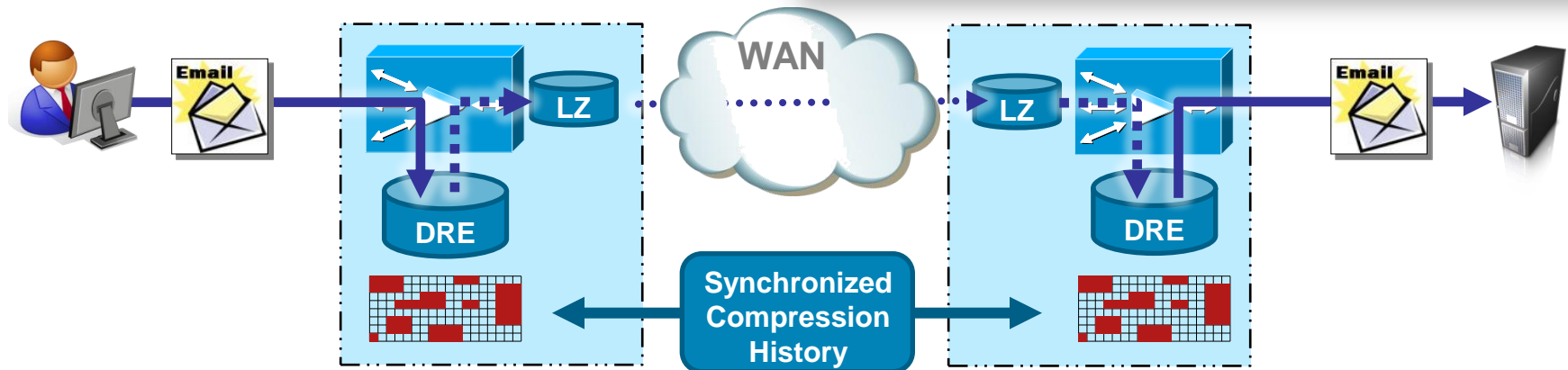
Advanced Compression

Solutions

- Data Redundancy Elimination (DRE)
- Persistent LZ compression

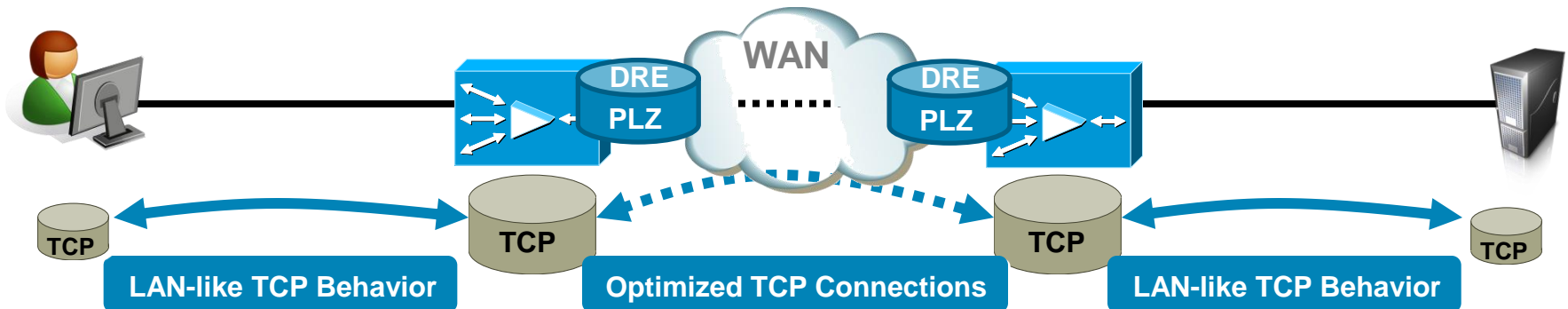
Benefits

- Application-agnostic compression
- Up to 100:1 compression
- Session-based compression
- Up to an additional 10:1 compression even after DRE



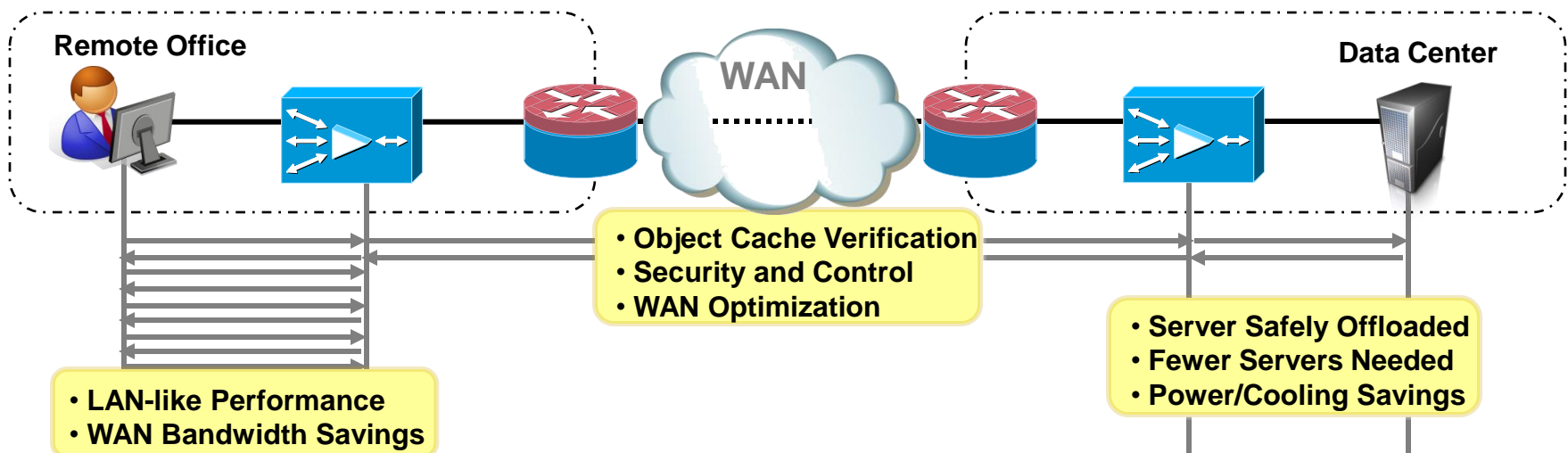
TCP Flow Optimization (TFO) Benefits

- Improves WAN bandwidth utilization and therefore application throughput
- Shields end-nodes from unruly WAN conditions
- TCP Proxy architecture provides LAN-like TCP behavior
- TFO provides adaptive buffering resulting in higher throughput



Application-Specific Acceleration

- Application and Protocol Awareness
 - Minimize chatter
 - Safe caching
 - Scheduled File preposition
- Intelligent Server Offload
 - Caching and optimizations
- WAAS Application Accelerators
 - CIFS, NFS, MAPI, Video, HTTP, SSL, Windows printing
- Licensed developed and validated with application vendors



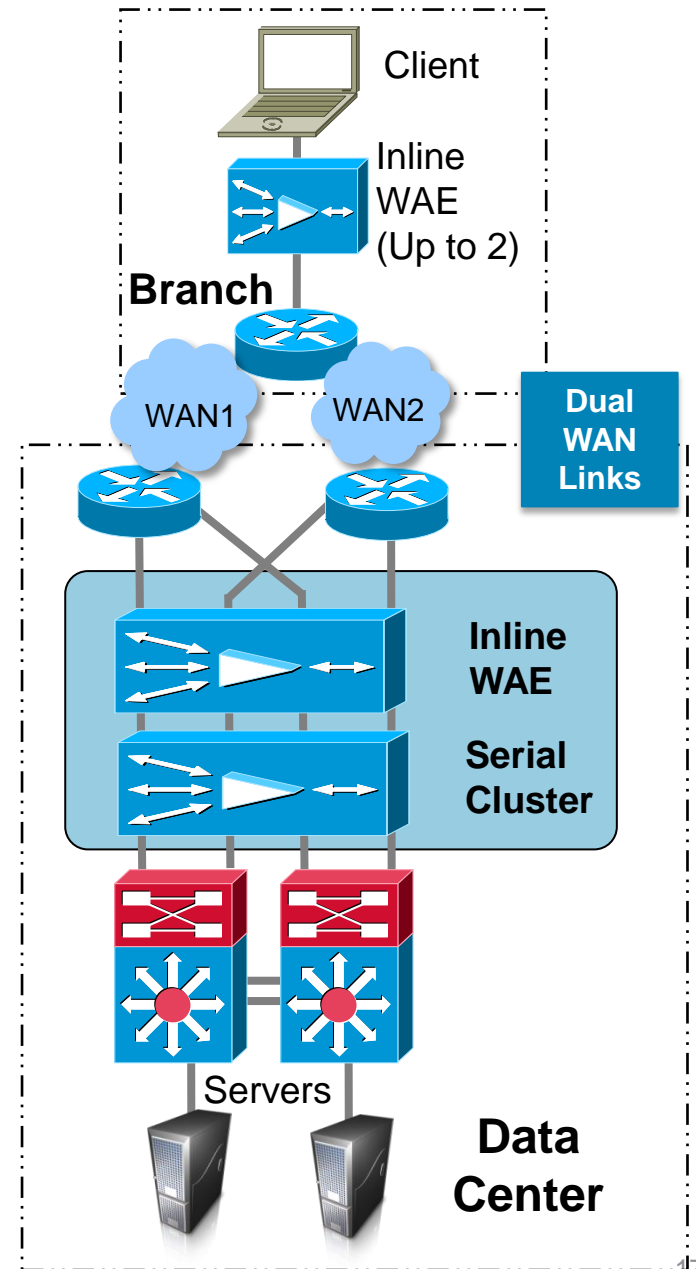
Simplified Data Center Interception Serial Inline Cluster

Solution

- Dual Inline Cards
 - Supports up to 4 inline groups
 - WAE-674, WAE-7341, WAE-7371
- HA supported by 2nd WAE
- Interception Access List
 - Bypass non-relevant traffic

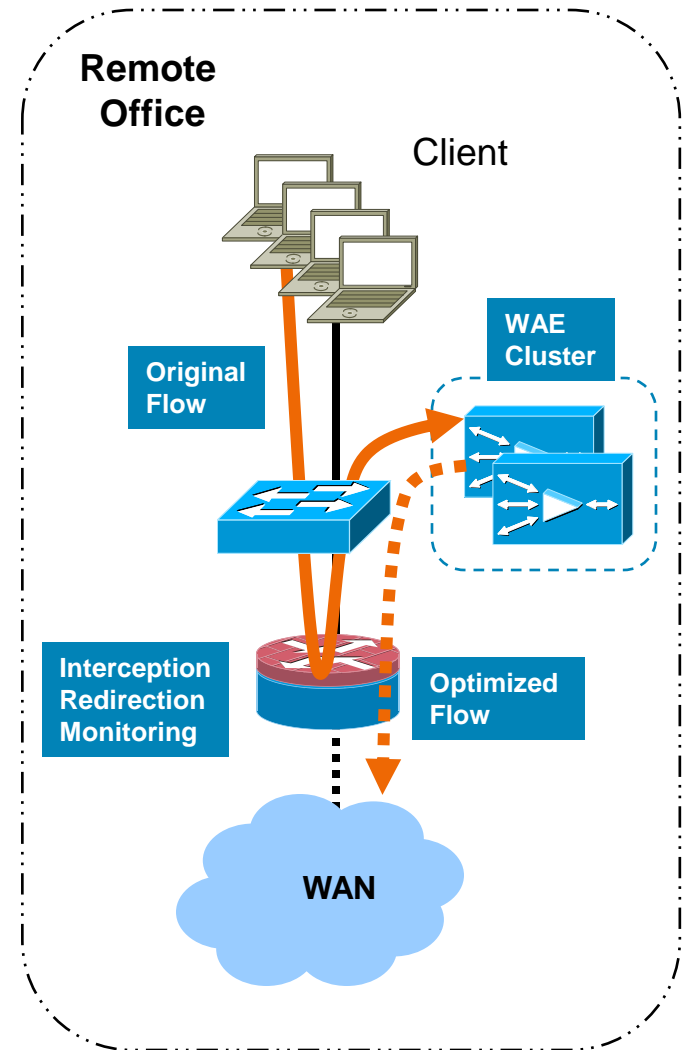
Benefits

- Simplified and highly available deployment model
- Small and medium data centers
- Simplifies PoC's.



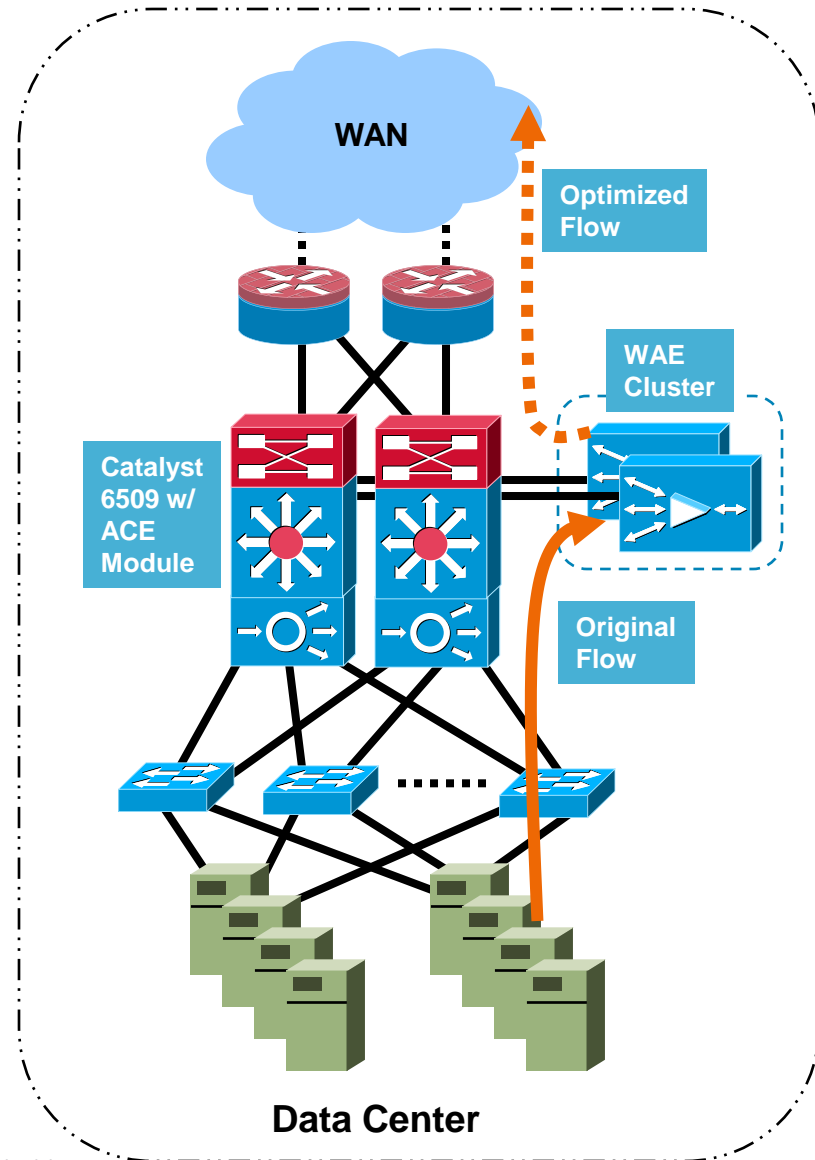
Network-Integrated Off-path Interception

- Transparent integration and automatic discovery regardless of interception method
- WCCPv2 Interception
 - Active/active clustering
 - automatic load-balancing
 - load redistribution
 - fail-over
 - and fail-through operation
 - Near-linear scalability and performance improvement when adding devices
- Policy-Based Routing Interception
 - Routing of flows to be optimized through a Cisco WAE as a next-hop router
 - Active/passive clustering



Scalable Data Center Integration

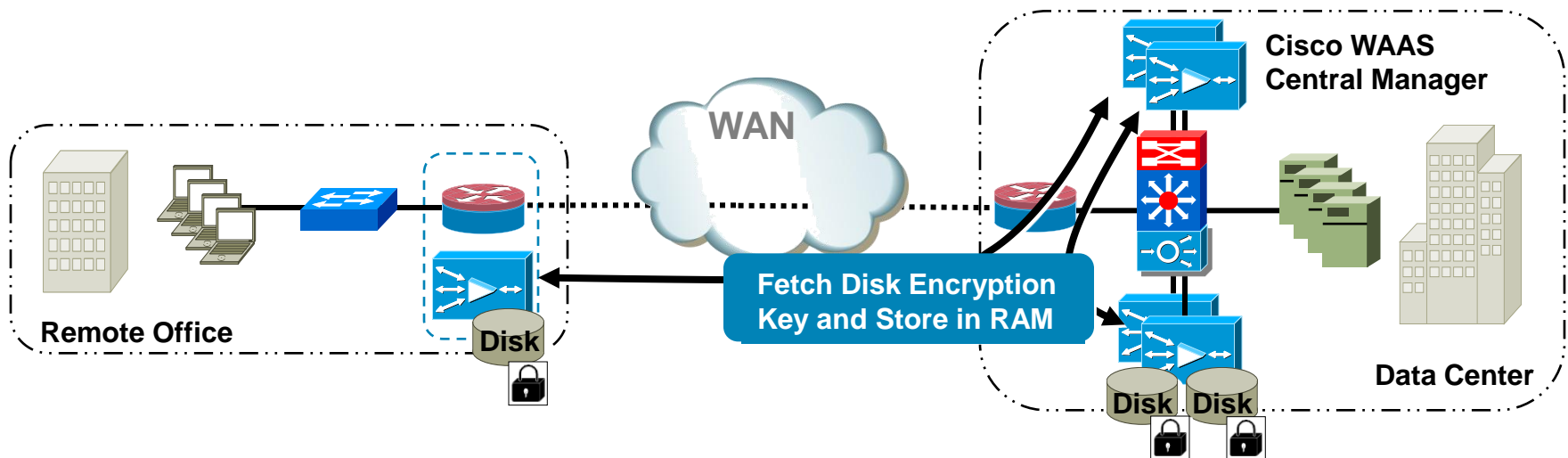
- Application Control Engine (ACE)
 - Appliance and Catalyst 6500 series module
 - Supports from 1Gbps to 64Gbps of aggregate throughput and up to 4M concurrent TCP connections
 - Cluster management for hundreds of WAE devices



Cisco WAE Disk Encryption

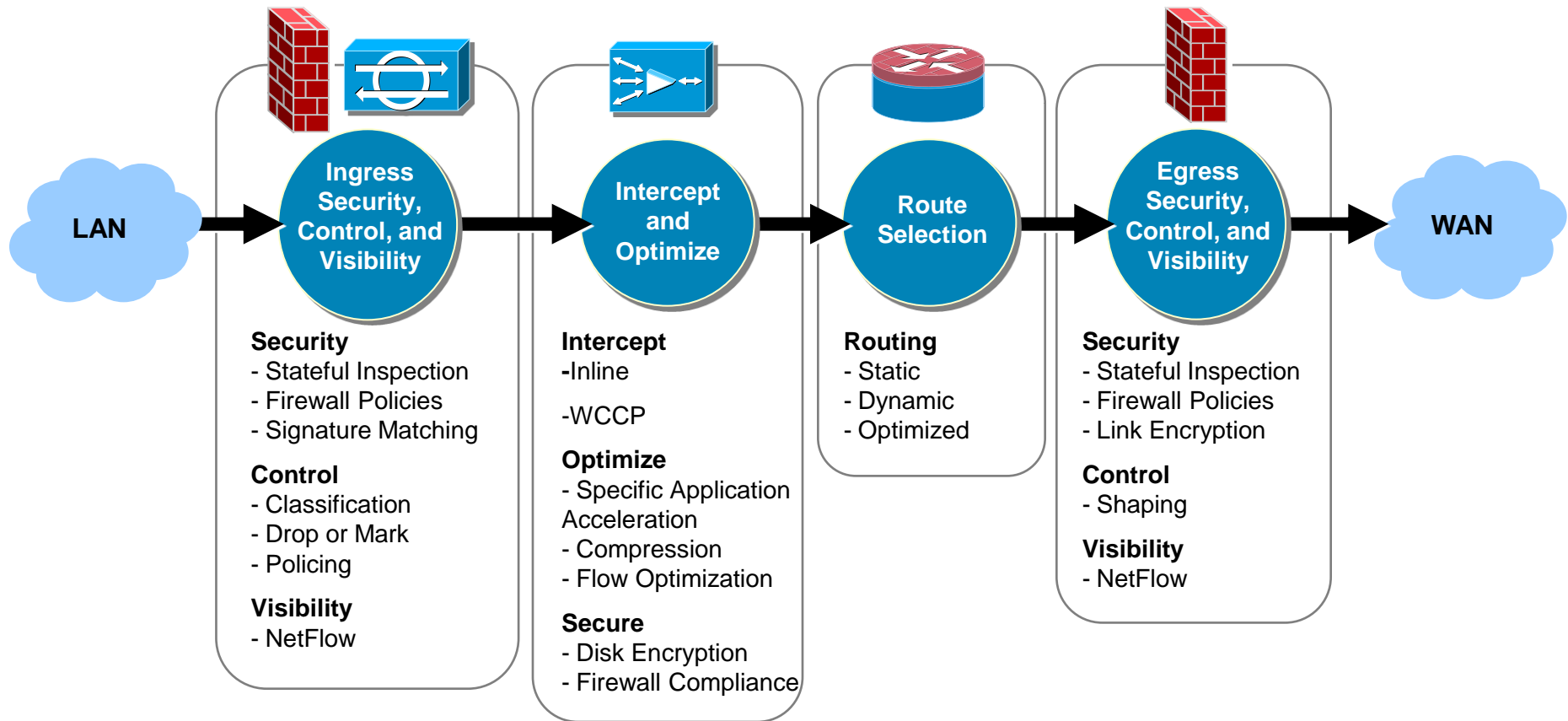
- An optional feature to mitigate concern of data theft due to stolen drives or physically compromised WAE devices
- Keys fetched from CM upon boot and stored in memory only
- Keys synchronized amongst Central Managers to ensure HA
- Standards-Based Strong Encryption

Follows FIPS 140-2 level 2 specification with certification to follow 256-bit Advanced Encryption Standard (AES) cipher



Secure WAN Optimization from Cisco

Cisco Integrated Services Router (ISR) - Integrated Security and WAN Optimization



Cisco WAAS integrates seamlessly and transparently into network security, visibility, and control functions

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MAPI Application Optimizer

Solution

- Full application support
- Asynchronous Writes
- Read Ahead
- Messages Decompression-
- DRE hints
- EndPoint Mapper

Challenge

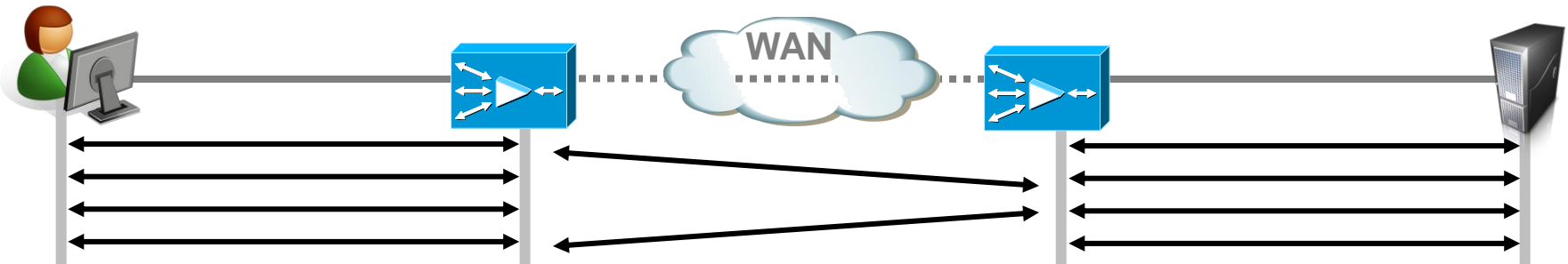
- Uses MS-RPC - chatty protocol.
- Exchanges many interactive control messages
- MAPI traffic is negotiated using MS Port Mapper (port 135) and is using dynamic ports
- Data encoding is negotiated by client/server

Benefit

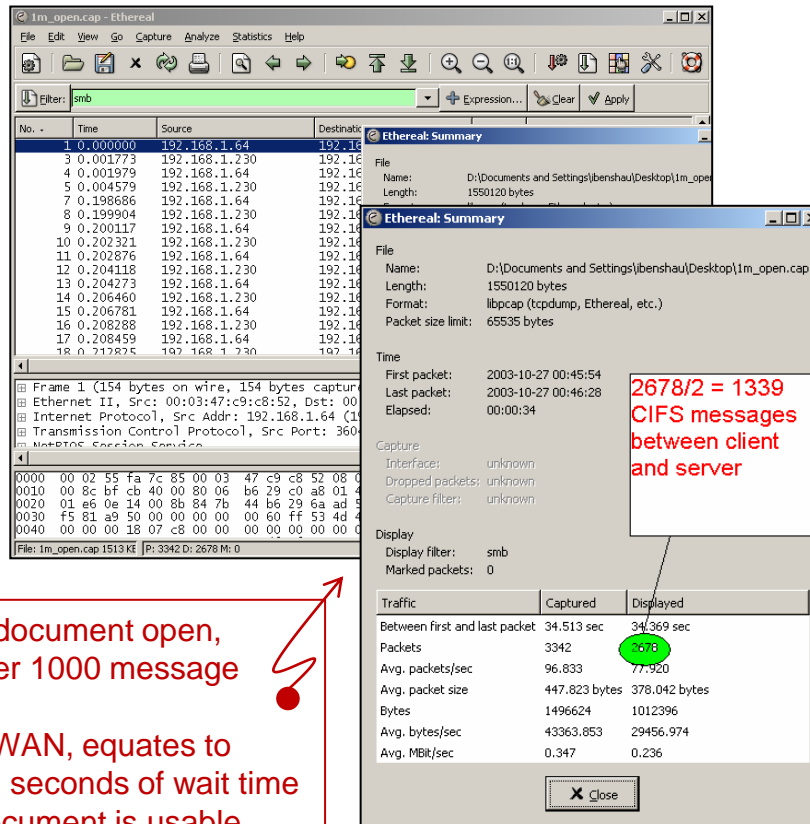
- Reduced send/receive time – key for Outlook 2000 users
- Cleans up the outbox faster – important for cached mode users
- Faster downloads of OAB, while significantly reducing BW consumption
- Optimizes native Outlook 2007 operations (disable encryption on server)
- Transparent, automatic optimization
- No reverse engineering (MSFT licensing)
- No security hole of keeping sessions open even after users have logged out

Client

SERVER



CIFS Application Optimizer: CIFS AO



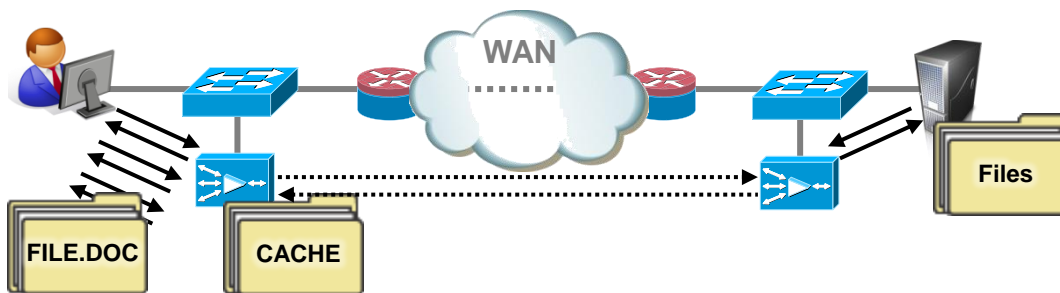
- 2MB Word document open, results in over 1000 message exchanges.
- 40ms RTT WAN, equates to more than 52 seconds of wait time before the document is usable

Challenge

- "chatty" protocols
- WAN's high latency, packet loss, and bandwidth constraints significantly diminishes Server access

Solution

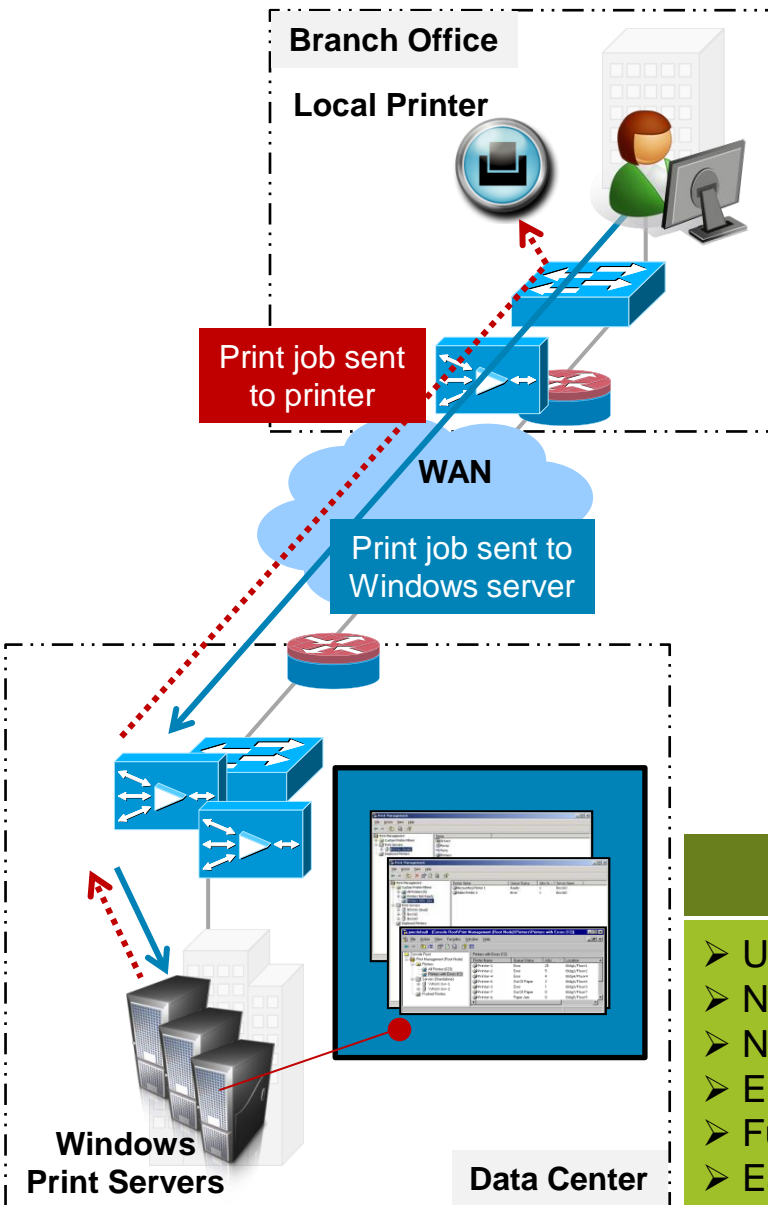
- File and Metadata caching
- Read-ahead
- Message pipelining
- Scheduled preposition to pre-populate
- Transparent integration
- Dedicated CIFS cache



Benefit

- Enable consolidation of distributed file and print resources into the data center without compromising performance
- Offload of Data Center Servers

Windows Printing Application Optimizer



Challenge

- MS Print protocol uses RPC - very “chatty”
- As A result over WAN it degrades exponentially as latency increases

Solution

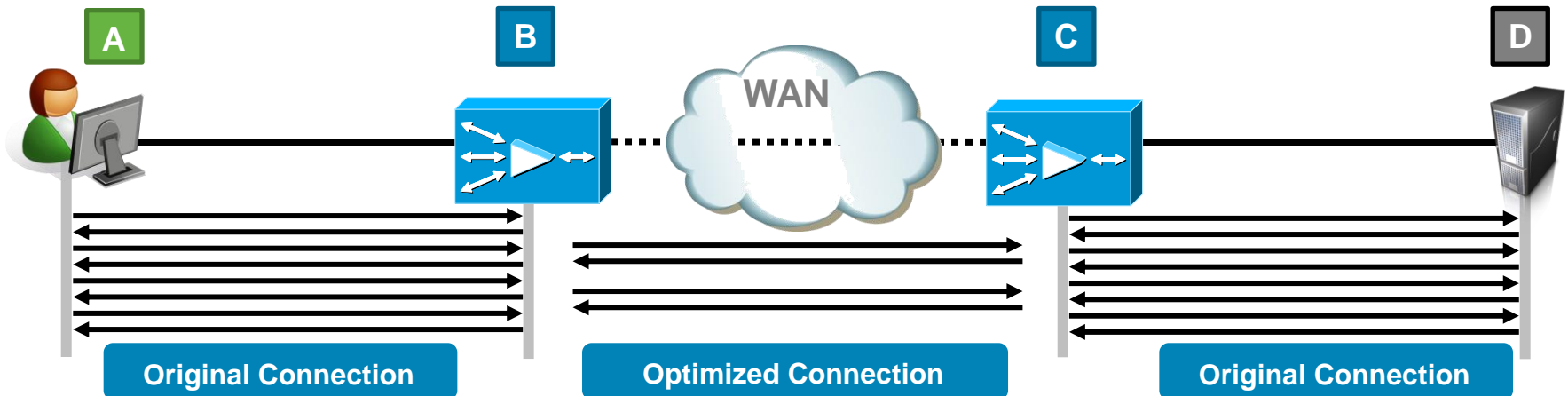
- Based on licensed MS Print Protocols
- Optimized access to print queue status and printer settings
- **Bi-directional Acceleration**
- Printer and Queue meta-data caching
- **Async write**
- **DRE hints** for enhanced payload compression
- **MS-RPC message optimization**
- **RPC command fragments handled asynchronously**
- **Delayed close of printer handles** (OPEN requests local)

Benefit

- Users print at near-LAN speeds
- No need for Network IT group to manage Branch Print
- No configuration on WAAS – just turn it on!
- Enable scalable centralized Windows Print services
- Fully Transparent to Windows AD Management
- Easy server migration from branch to datacenter

NFSv3 Application Optimizer

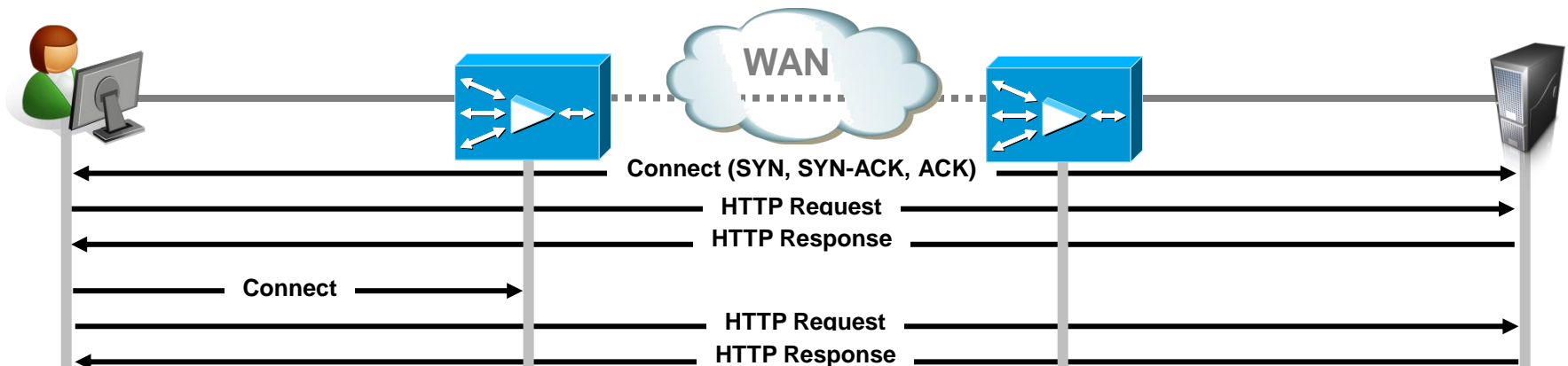
Solution	Challenge
<ul style="list-style-type: none">➤ Read-Ahead➤ Asynchronous write➤ DRE hints➤ Meta-data caching	<ul style="list-style-type: none">➤ In Unix, NFS protocol is used for large file exchange such as software builds, CAD applications and large directory access➤ NFSv3 is a “chatty” RPC protocol➤ Clients cannot efficiently operate on high-latency/high-bandwidth WANs
Benefit	
<ul style="list-style-type: none">➤ Can fill high-bandwidth links regardless of latency➤ Transparent to client and server. No configuration required.➤ Tested for compliance with IBM AIX, Linux and Solaris clients + Leading NAS vendors!	



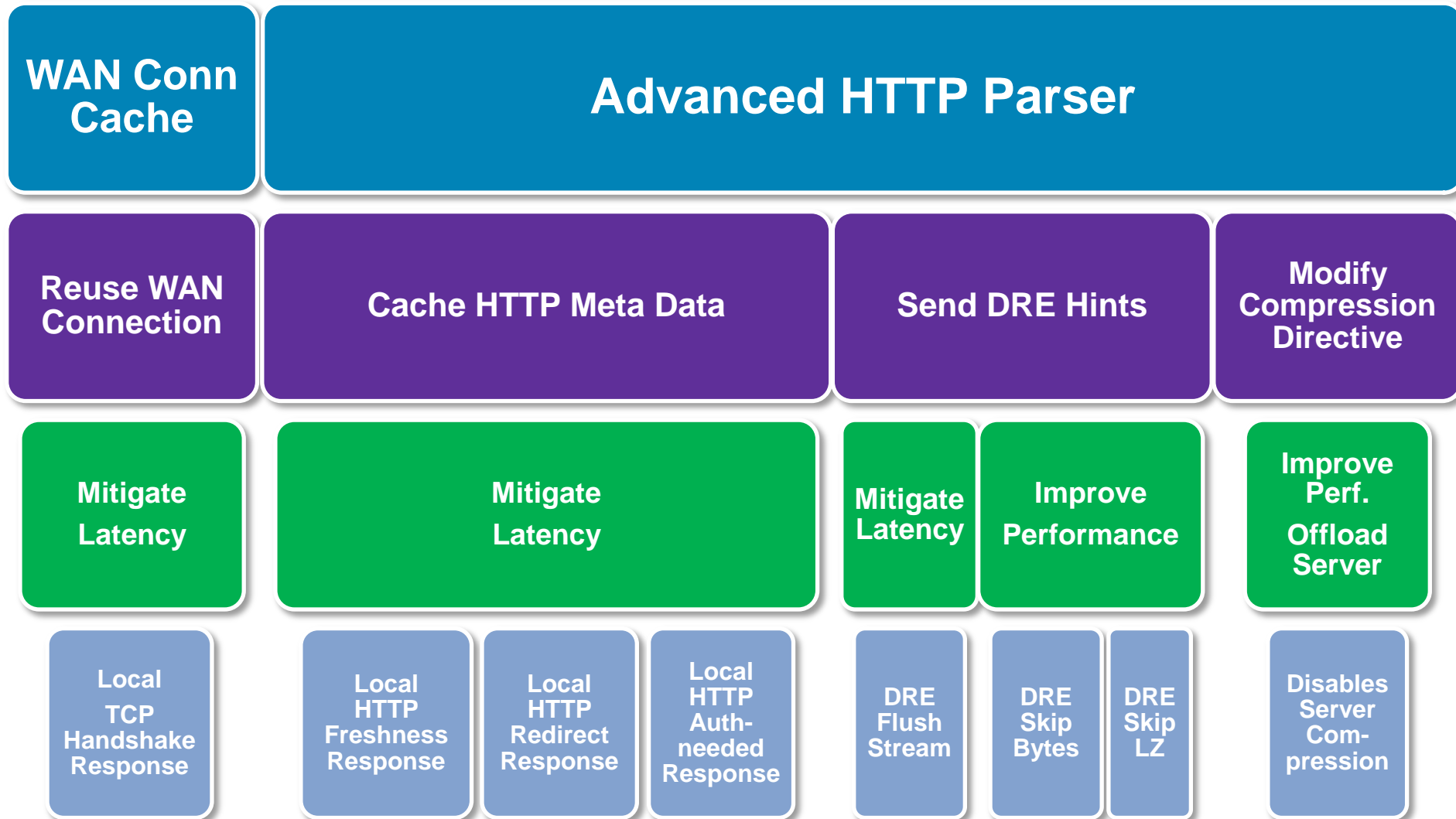
HTTP Application Optimizer

Solution	Challenge
<ul style="list-style-type: none">➤ Fast Connection Reuse➤ Proxy Connect to SSL Servers➤ Local HTTP responses through Metadata cache➤ Content-aware optimization<ul style="list-style-type: none">➤ DRE hints➤ Server compression offload	<ul style="list-style-type: none">➤ Slow page load on Interactive Web applications➤ Browsers serially open and close connections to fetch small objects (e.g graphics)➤ Latency due to HTTP request/response

Benefit
<ul style="list-style-type: none">➤ Mitigates latency due to HTTP request/response➤ Fully transparent➤ Reuse of same pair of client and server requests➤ Compliments and preserves http application pipelining

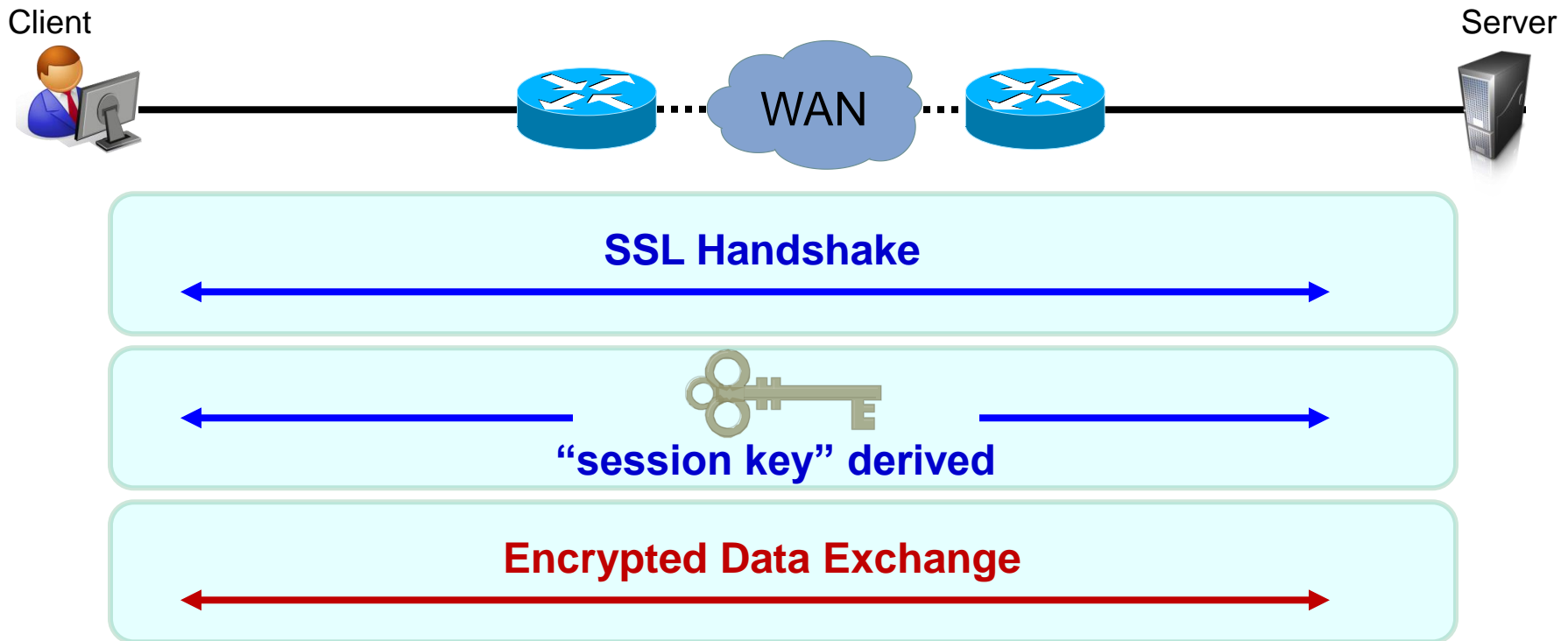


HTTP AO - Building Blocks



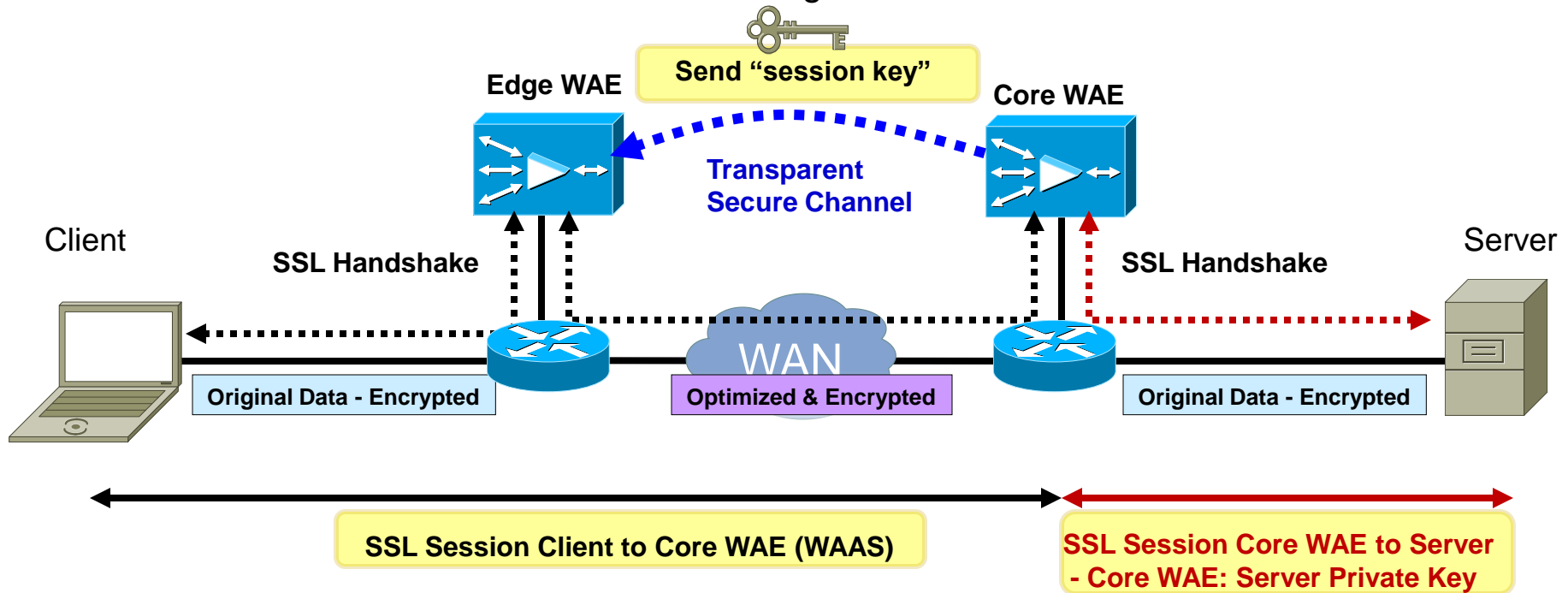
The Need for SSL Acceleration

- WAAS optimization benefits are maximized only when applied to decrypted payload

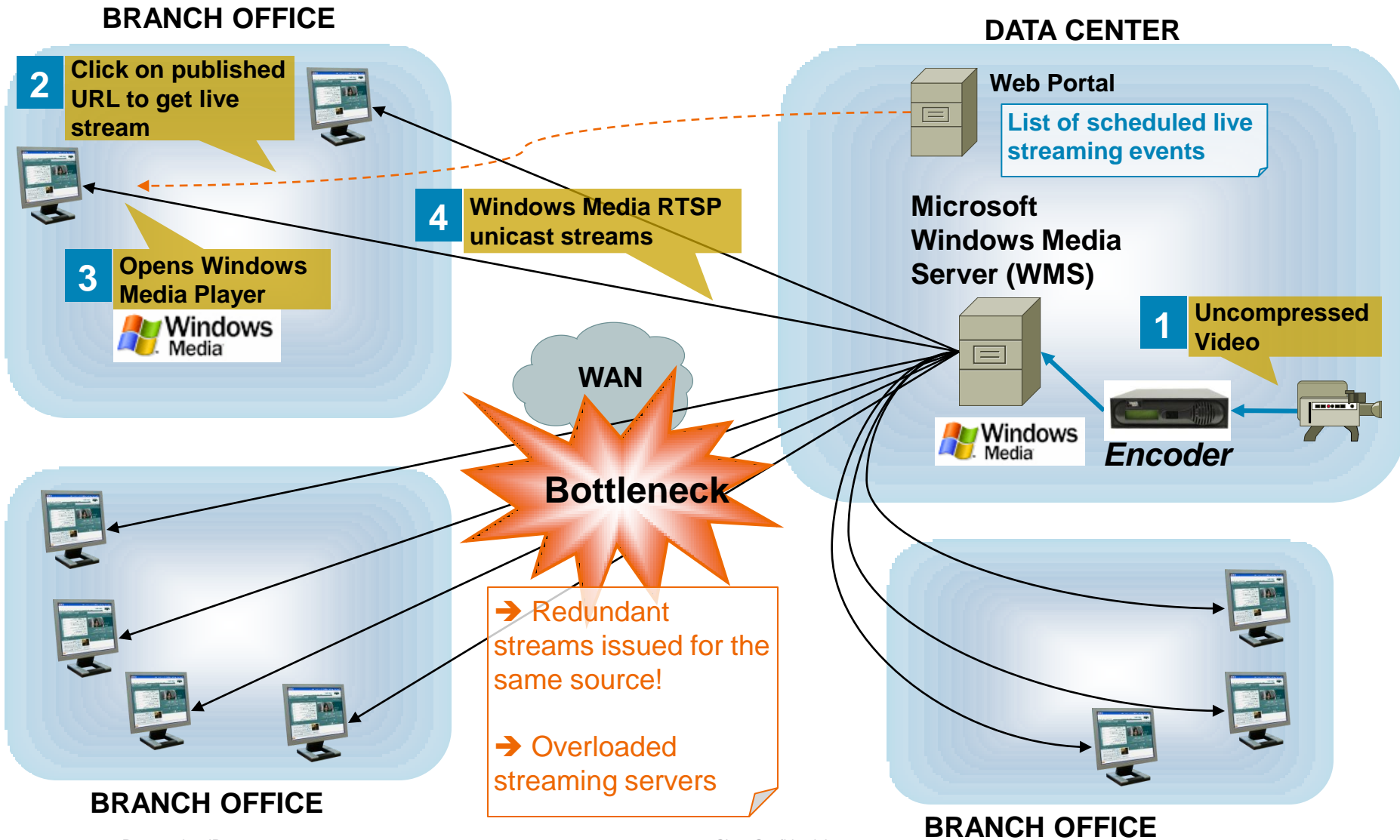


Cisco WAAS SSL Optimization Solution

- Core WAE acts as a Trusted Intermediary Node for SSL requests by client
- Private Key and Server Certificate are stored on the Core WAE device
- Core WAE participates in SSL Handshake to derive “session key”
- Distributes the “session key” securely in-band to the Edge WAE over the established connection between the Edge WAE and Core WAE



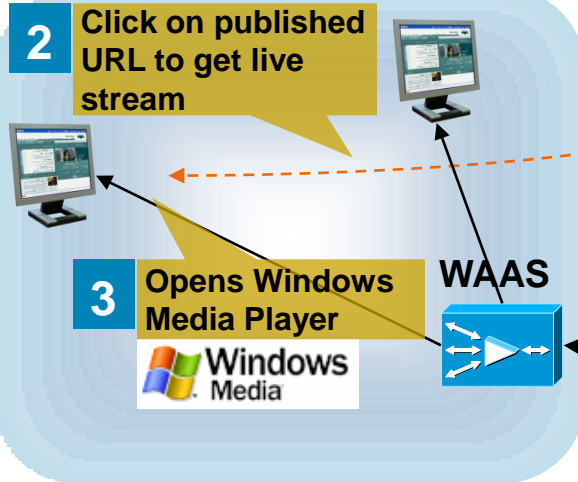
Live Video Streaming for Windows Media Environment



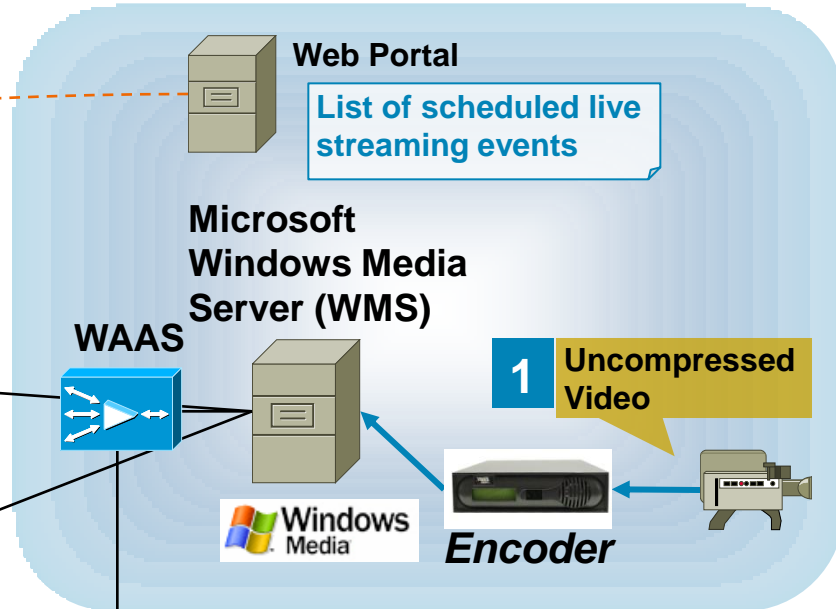
Live Video Streaming with WAAS

Edge stream splitting

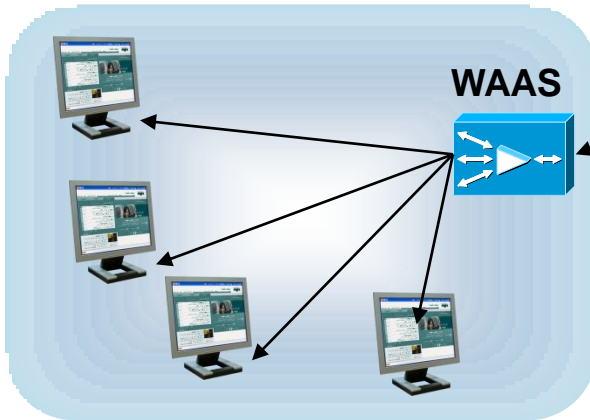
BRANCH OFFICE



DATA CENTER

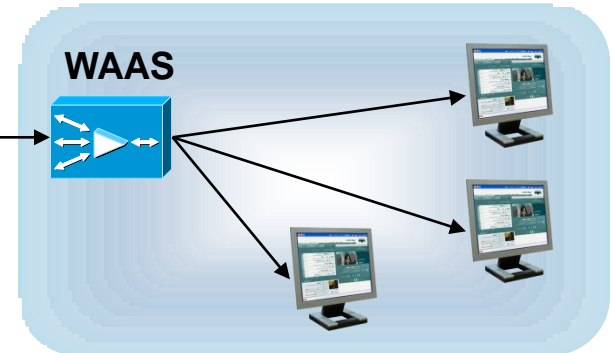


WAN



BRANCH OFFICE

- ➔ Only one stream per remote site
- ➔ auto-detect RTSP connections (no configuration required)



BRANCH OFFICE

Note: Separate WAAS license for Windows Media Live Streaming required per contract w/Microsoft

Agenda



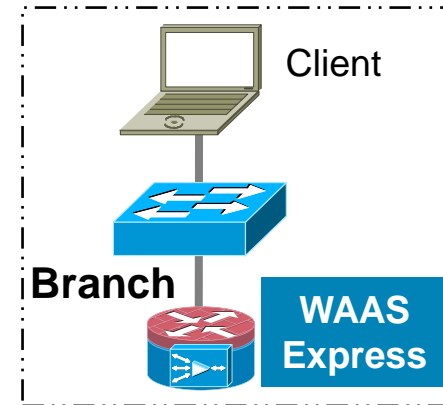
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Cisco WAAS Express

IOS based Integrated WAN Optimization solution

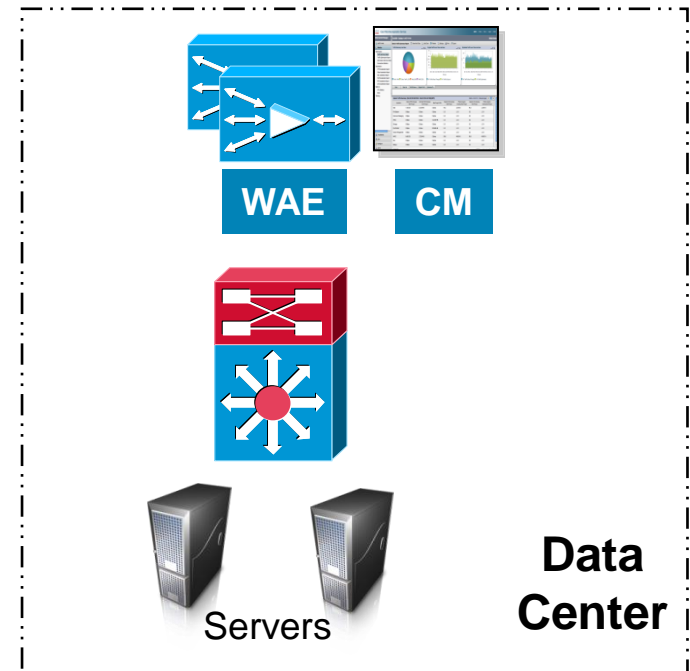
Solution

- Bandwidth optimization
- Fast delivery of data over low speed, high latency WAN links from data centers



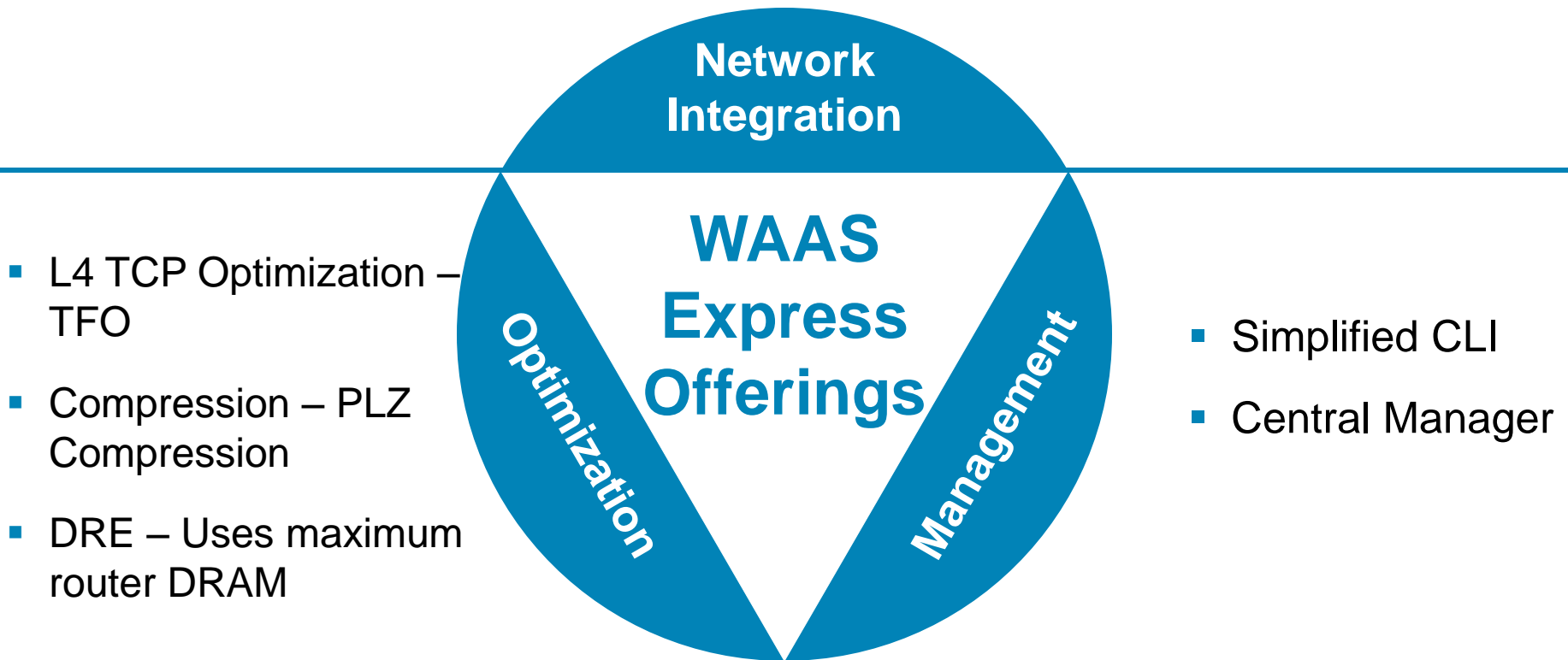
Benefit

- Small-footprint cost-effective software solution, transparently integrates into the ISR G2
- Natively uses capabilities of Cisco IOS® Software
- Increases remote user productivity
- Reduces WAN bandwidth costs
- Offers investment protection by interoperating with existing Cisco WAAS infrastructure.



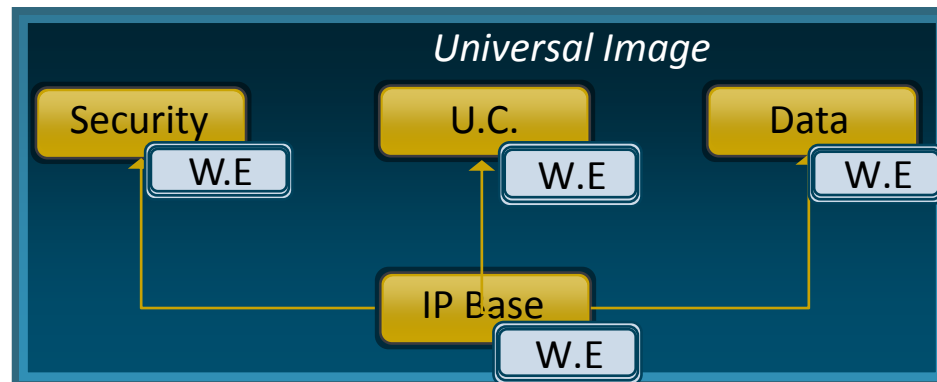
Cisco WAAS Express

- Compatible with WAAS Headend Devices
- Inline IOS feature - Interoperates with IOS Security and QoS features
- Support for mixed devices (WAAS appliances, network modules, WAAS Express)

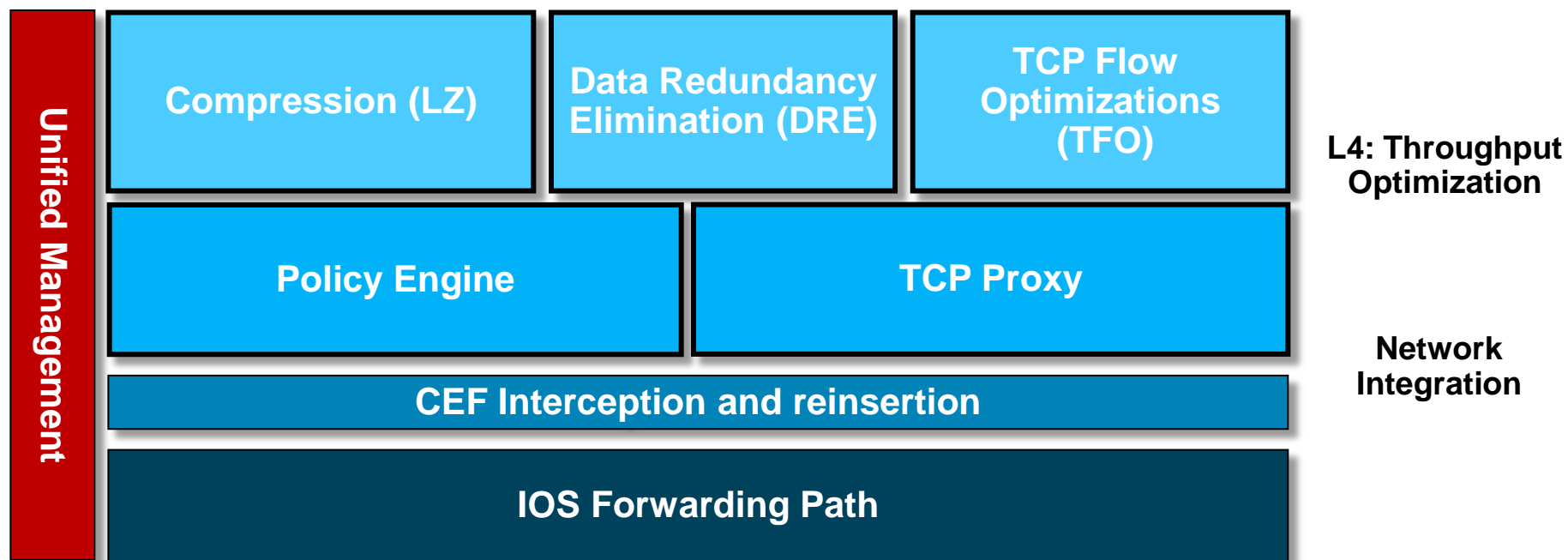


WAAS Express – Packaging & Licensing

- WAAS Express is a feature license which can be enabled with any technology package licenses
- Enforced using a license key
- License key enforcement done in IOS on the router using Cisco Software Licensing Infrastructure
- 60 day trial license available
- WAAS Express will not register with WAAS Central Manager unless valid and active license is present
- WAAS Central Manager will periodically ensure (trial and extension) license is active to allow customer configuration



WAAS Express Software Architecture



Agenda



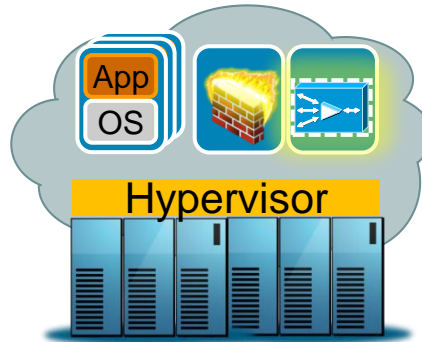
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Unified Network Services Provides a Common Framework For Physical and Virtual Services

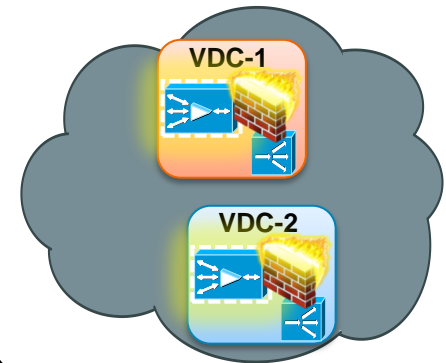
Physical Network Services



Private Cloud



Public Cloud

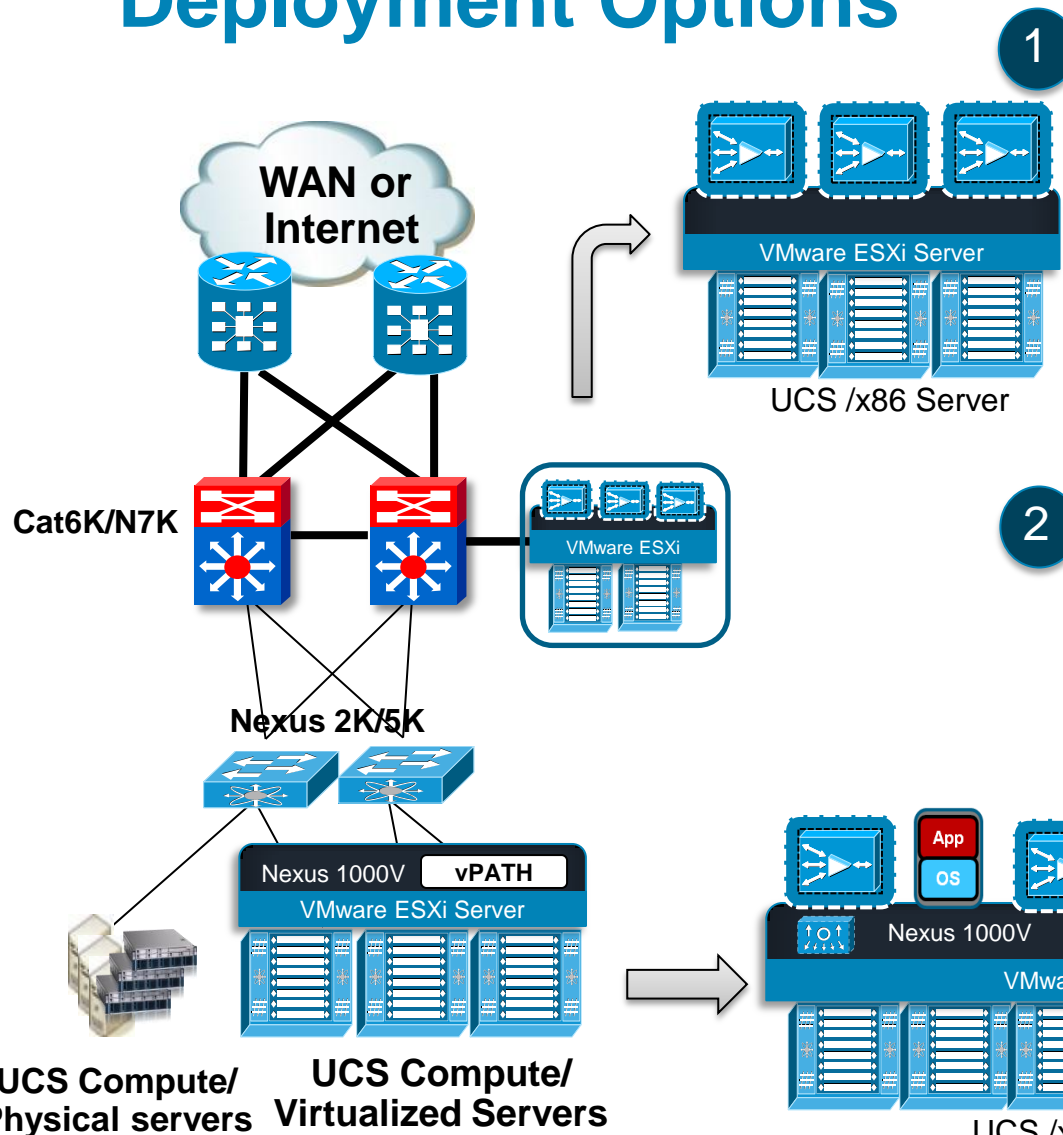


- Application-specific service nodes
- Form factors:
 - Appliance
 - Switch module
 - Router-integrated



- Virtual appliance form factor
- Elastic Instantiation/Provisioning
- Service transparent to VM mobility
- Support scale-out
- Large scale multi-tenant operation

Cisco vWAAS Provides Flexible Cloud Deployment Options



1

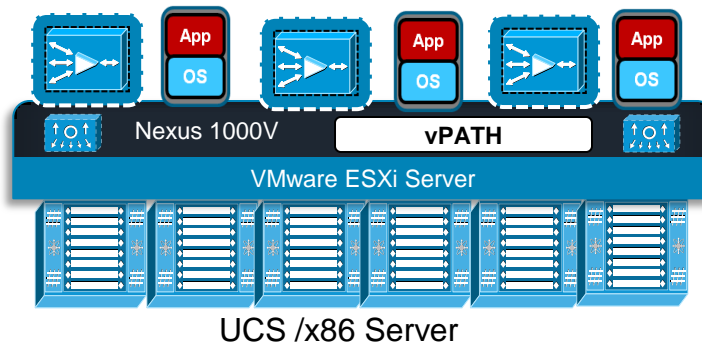
Private Cloud

- Traditional WAN Edge Deployment at Branch and DC
- Gradual migration from Physical to Virtual
- Multi-tenancy support

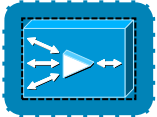
2

Private Cloud, Virtual Private Cloud, & Public Cloud

- Re-direction using vPath @VM level
- Elastic provisioning
- Multi-tenancy support



vWAAS and vCM Models



vWAAS-750

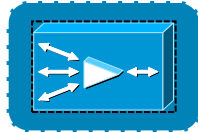
750

(Opt.TCP Connection)
WAN BW : **8 Mbps**

Resources

Virtual Cores : **2**
Memory : **4 GB**
Hard Disk: **250 GB**

Modeled after 574



vWAAS-6000

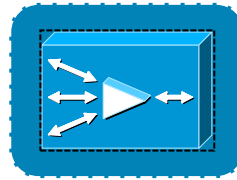
6000

(Opt.TCP Connection)
WAN BW : **90 Mbps**

Resources

Virtual Cores: **4**
Memory : **8 GB**
Hard Disk: **500 GB**

Modeled after 674



vWAAS-12000

12000

(Opt.TCP Connection)
WAN BW : **310 Mbps**

Resources

Virtual Cores: **4**
Memory : **12 GB**
Hard Disk: **750 GB**

Modeled after 7341

- Use UCS-based sizing results as sizing benchmarks for other x86 platforms
- Mileage will vary with non UCS platforms; approach similar to other s/w vendors

The performance results are based on benchmark testing done on following

1. Cisco UCS C210 M2 with 2 Intel Xeon x5650 CPU (2.67 GHZ)
2. Cisco UCS B250 M2 with 2 Intel Xeon x5650 CPU (2.67 GHZ)



vCM-100N

100

(Max Devices)

Resources

Virtual Cores : **2**
Memory : **2 GB**
Hard Disk: **250 GB**

Modeled after 274



vCM-2000N

2000

(Max Devices)

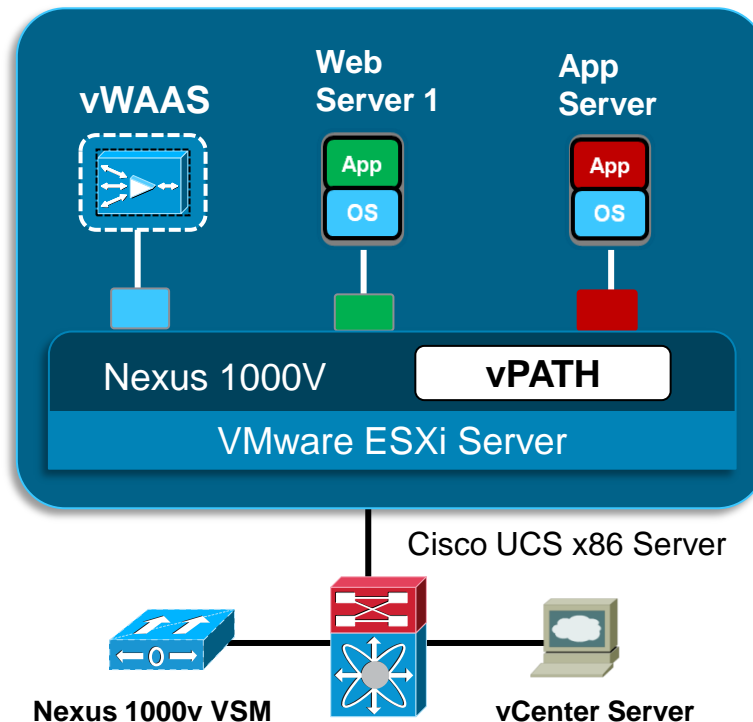
Resources

Virtual Cores: **4**
Memory : **8 GB**
Hard Disk: **600 GB**

Modeled after 674

vWAAS vPATH Interception (based on Nexus 1000V)

- Interception based on port-profile policy configured in Nexus 1000v
- **Bidirectional Interception** - (no IN/OUT configuration)
- **Pass-through traffic automatic bypass**



On-Demand Orchestration and Elasticity	Application based interception	Virtual machine mobility awareness	Fault Tolerant persistent performance	Multi-tenancy with flexible deployment
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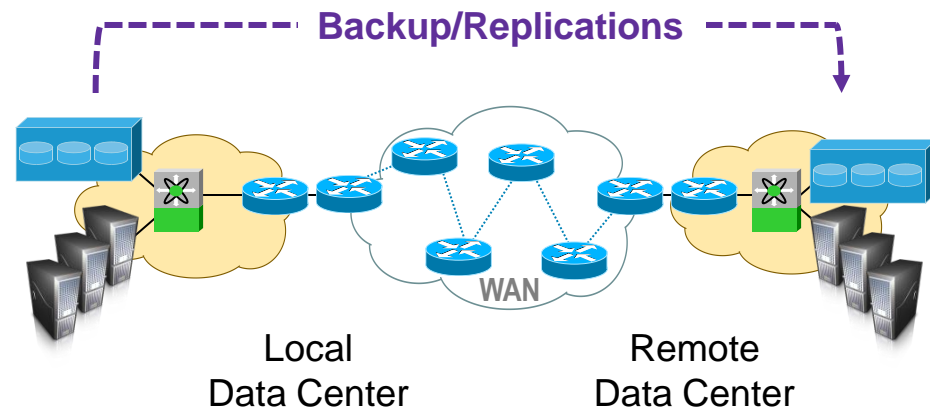
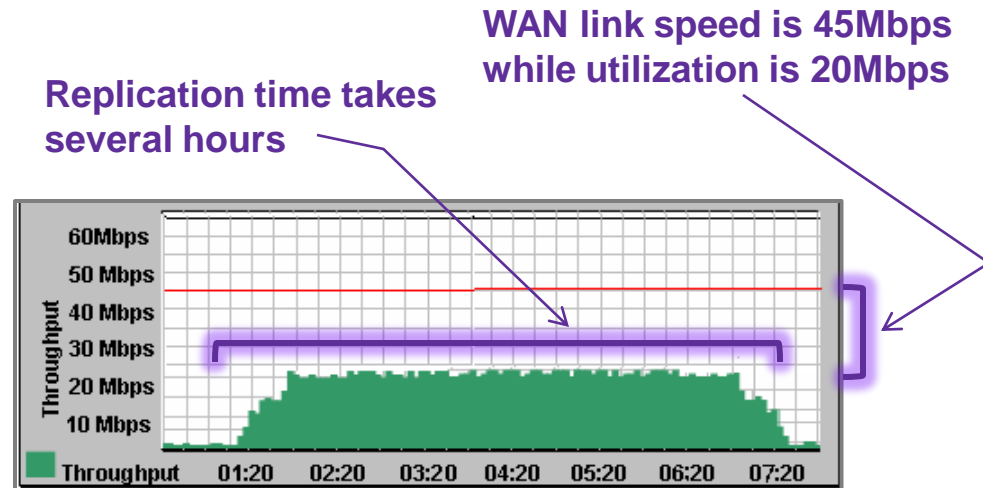
Agenda



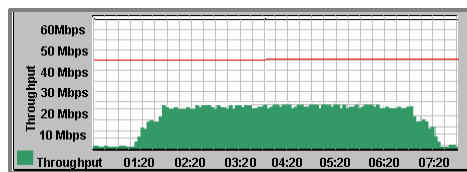
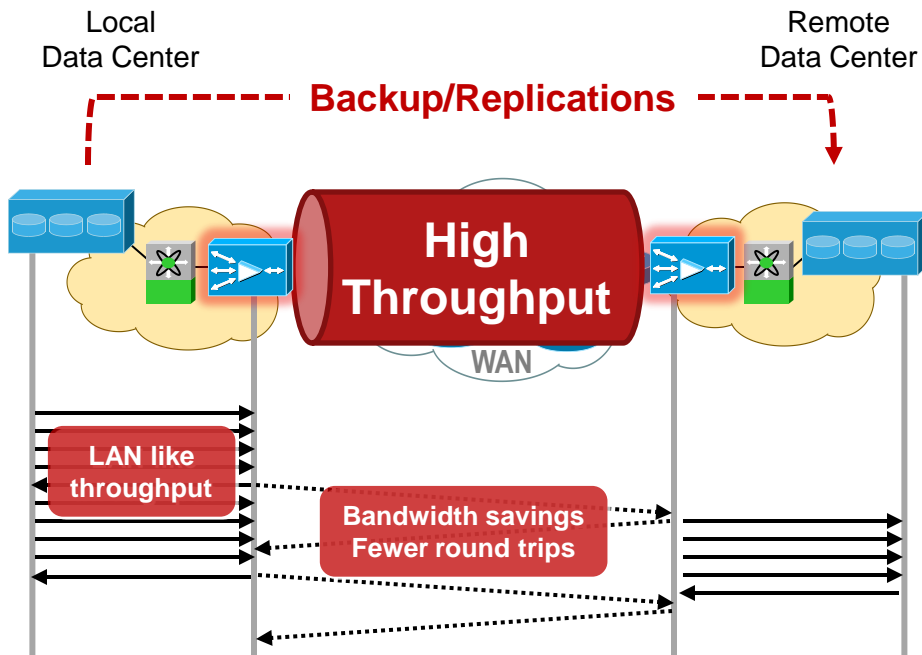
- Enterprise Application Delivery Challenges
- Introducing Cisco Wide Area Application Services
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Data Backup/restore and Replications

- Online data backup/restore
 - Backup accessible over WAN
 - Reduces recovery time
- Data replication
 - Continuous data synchronization across the network
 - Rapid failover to remote DC for 24/7 data availability
 - Reduced recovery time and improved overall recovery

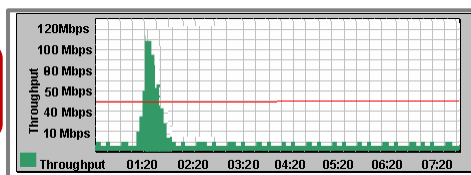


Replication and backup Optimization



No WAAS

WAAS enabled with Replication Accelerator Mode



Challenge

- Requires costly High Bandwidth Low Latency Links
- Inability of storage systems to fill WAN link due to latency/packet loss issues
- Need to increase the distance of the disaster recovery site

Solution

- Device Mode purposely designed for DC-to-DC replication and backup optimization
 - Optimized for High Speed Links, Low Connection Count, and Low Fan-out
 - Supported on DC devices WAE-73x1
 - Branch/DC and DC/DC managed from same WAAS Central Manager (CM)
- 3rd party data replication solutions support
 - EMC SRDF/A, NetApp SnapMirror
 - Solution does not preclude acceleration of other replication protocols

Benefit

- Back-up/Replication window reduction up to 5x
- Improved throughput and WAN link utilization
- Meet RPO and RTO

Agenda

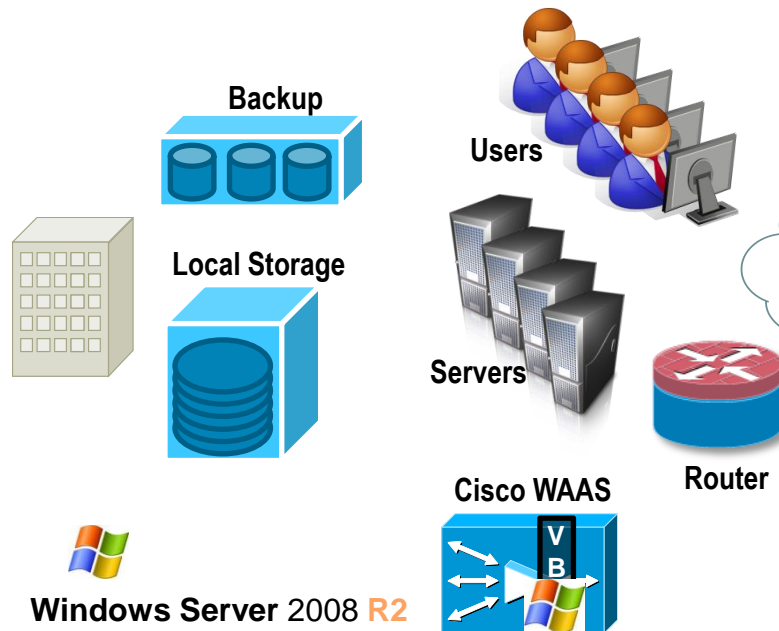


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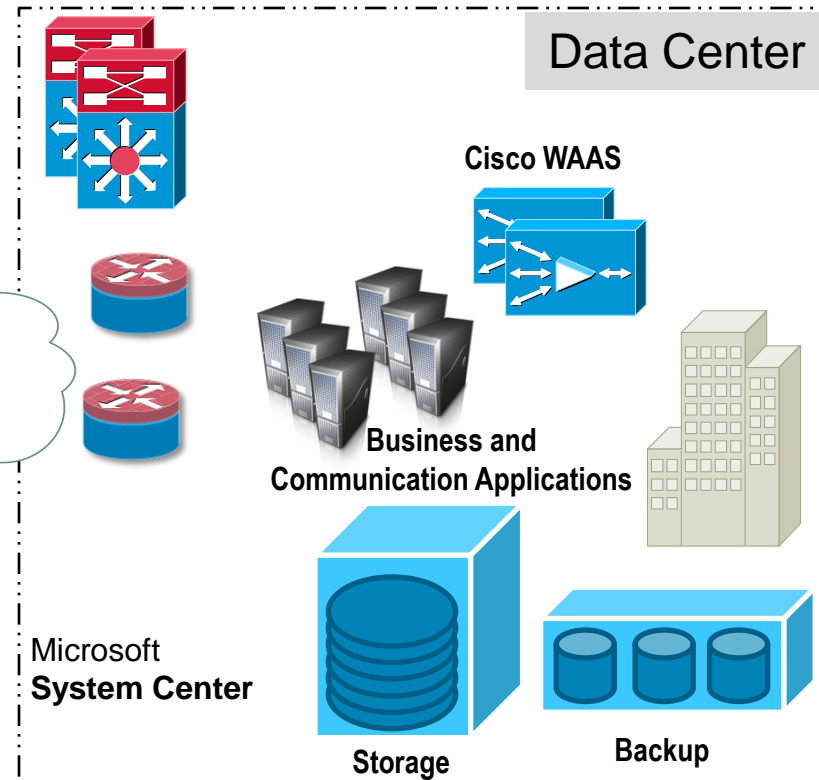
Virtualized Application Delivery for Branch Office – Cisco WAAS Virtual Blade

- Centralize what you can with WAAS
- Locally host services (e.g. Windows Servers) on same WAAS device

Flexible, Optimized Branch IT



Data Center



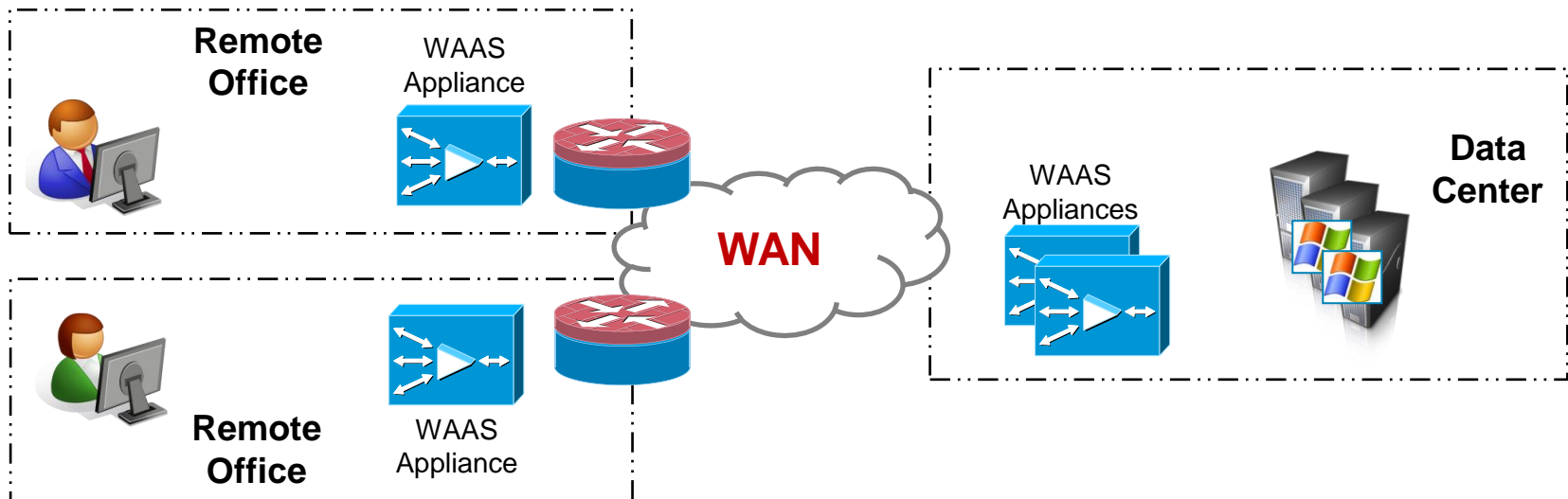
Cisco WAAS Virtual Blade technology

Providing Best Mix of Distributed and Centralized IT Services

Validated by Microsoft for Windows Services

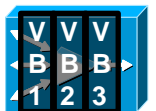
Virtual Blade Deployment

- Allocate resources and start Virtual-Blade instance
Easy & Simple - from WAAS CM or from CLI
- Centrally deploy server image over to WAE
From CLI or WAAS CM, using FTP or HTTP



Virtual Blade Offerings

- Broad range of services
 - **Microsoft Windows Services** (e.g. DNS, DHCP, SCCM)
 - **Custom applications** (internally developed)
 - **Other applications** (NAM, ACNS, Altiris)
- Improved performance, scale and usability
 - **Multiple CPUs** for VB (SMP) for higher compute performance
 - **Network I/O Paravirtualization** for higher network performance
 - **Remote Network Boot Install (PXE)** for agile provisioning
- **Microsoft SVVP validated** for Windows Server 2003, 2008 and 2008 R2



Microsoft and Cisco Solution

Microsoft Windows Server 2008 Server Core

- Broad range of services (DNS/DHCP/SCCM/...)

Cisco WAAS with Virtualization

- Complete WAN optimization + application acceleration
- SVVP certification on 2008 R2 (broader range of windows services)

Cisco WAAS with pre-packaged Windows Server 2008 services



- ✓ Jointly developed architecture
- ✓ Joint customer support

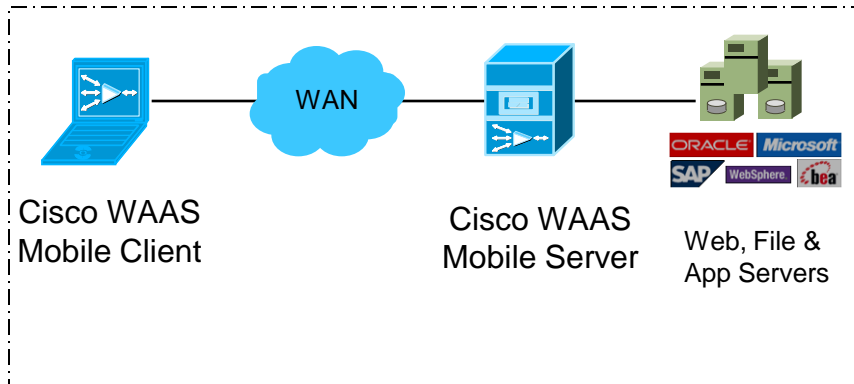
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Cisco WAAS Mobile Architecture

1. Client/Server Architecture



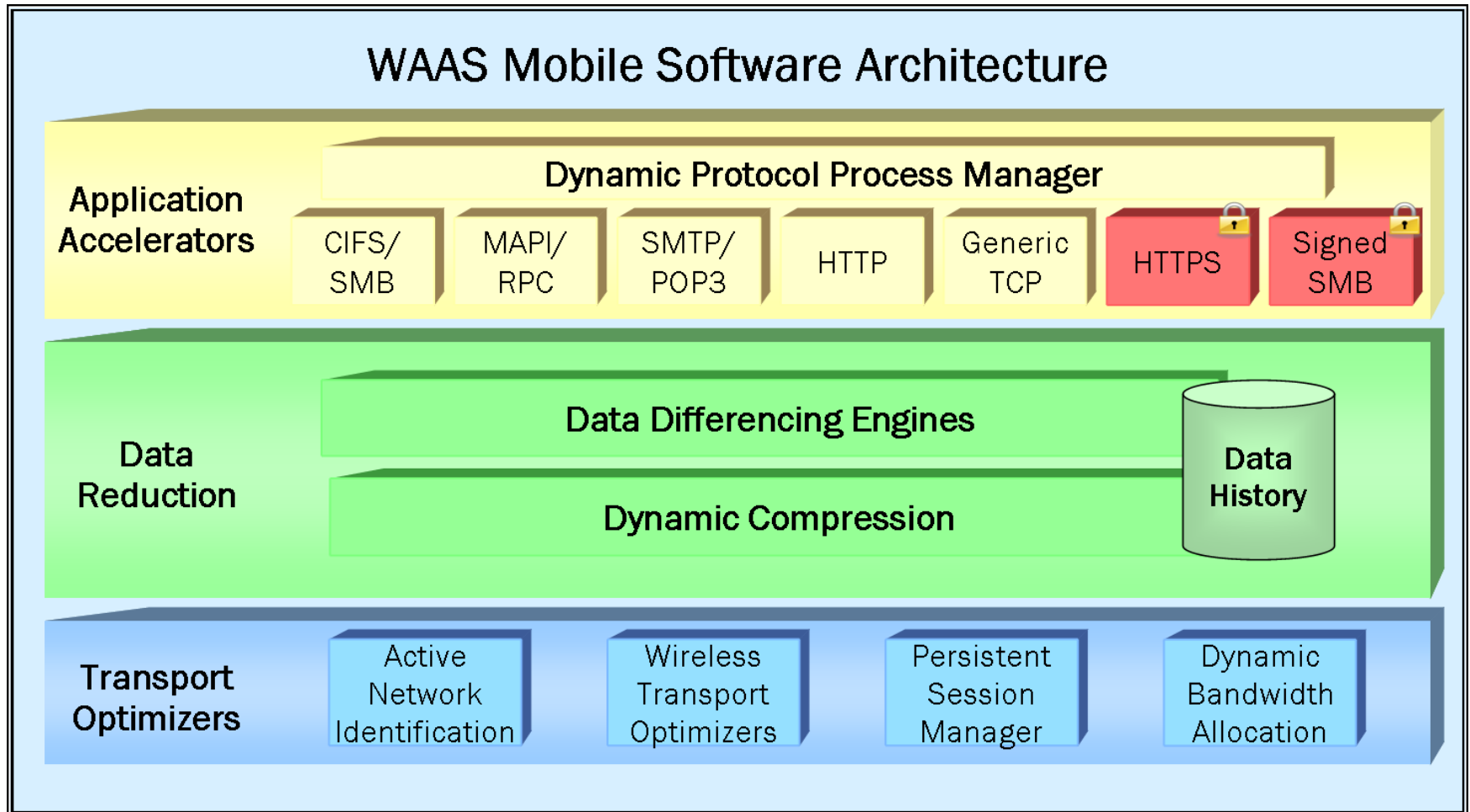
2. What It Does

- Installs on Windows Desktop
- Accelerates Application Performance over Challenged Mobile or Remote Connections

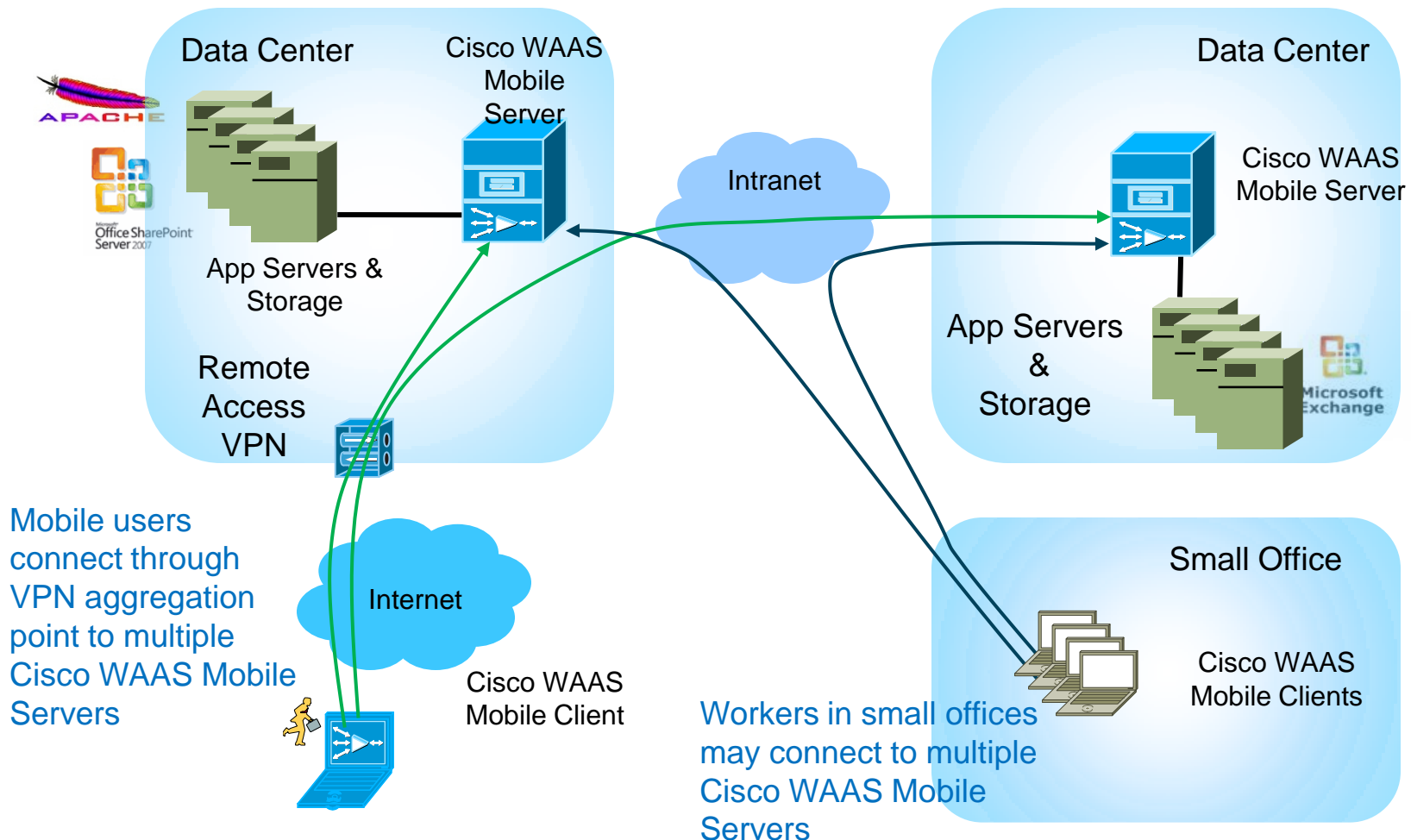
3. Why It's Better

Purpose Built for the Windows PC/Laptop	<ul style="list-style-type: none">▪ Designed for Mobile & Remote Users▪ Optimized for Diverse Challenged Networks▪ Complements WAAS Appliance as Complete Acceleration Solution
Industry-leading Performance	<ul style="list-style-type: none">▪ Highest performance over mobile and SOHO networks▪ Scalable, Fault Resilient, Manageable, Interoperable
Lowest TCO	<ul style="list-style-type: none">▪ Best reliability, stability and troubleshooting tools reduce cost of support▪ Centralized policy based management reduces deployment and support cost▪ Integration with software distribution tools reduces deployment costs

Cisco WAAS Mobile Architecture Overview



Cisco WAAS Mobile Networking: *Deployment Topology*



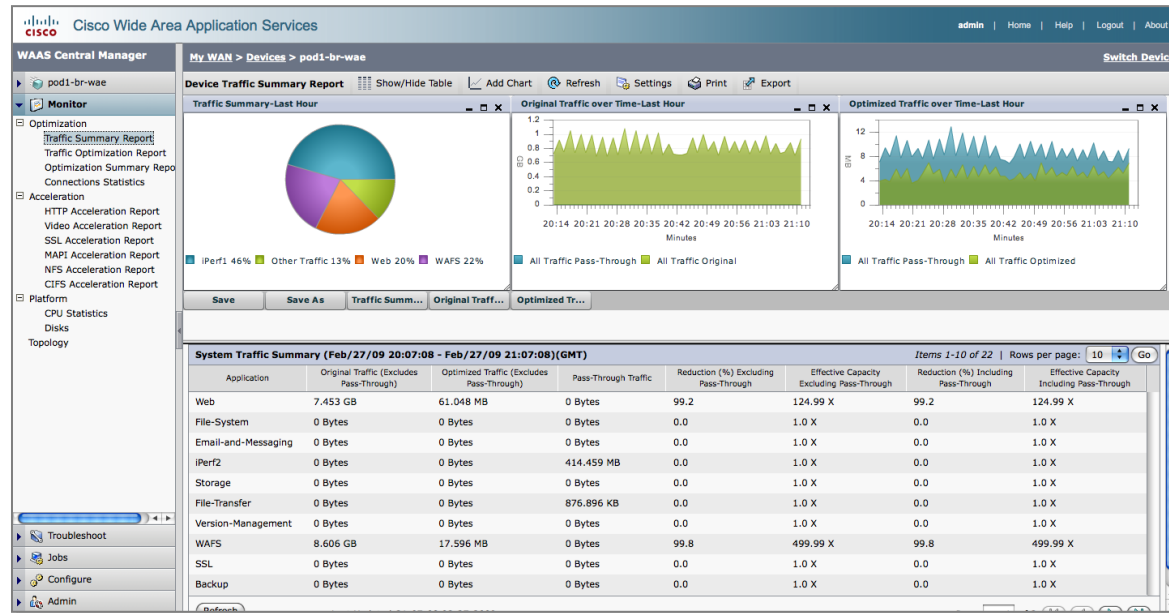
Simultaneously accelerate traffic to applications hosted in multiple data centers

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Scalable, Secure Central Management

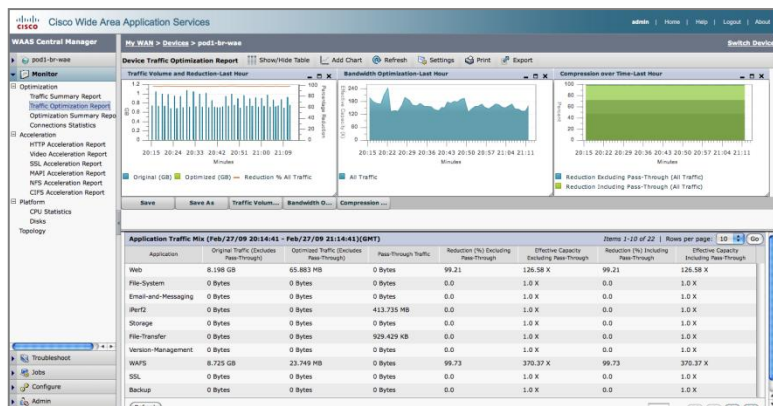


- Centralized Management
 - Robust management, monitoring, and reporting for up to 2000 nodes
 - Device grouping for simplified rollout of configuration changes
 - Device and system alarms, as well as integration with SNMP and syslog
- Platform support: WAAS appliances, WAAS Modules, WAAS Express, vWAAS
- SOA-ready Monitoring
 - Standard XML Web Service (SOAP)
 - Integration with external reporting and monitoring portals

Secure Management & High Availability

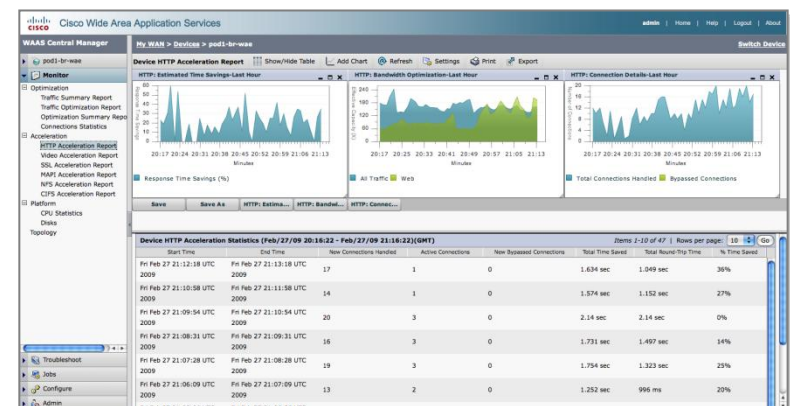
Secure Management

- SSL-encrypted HTTP GUI and intra-device communication
- Roles-based Access Control (RBAC) to isolate users to specific capabilities and domains of management
- Integrated IOS-like CLI accessible via SSH (also telnet, serial)



High Availability

- Active/standby deployments with automatic failover,
- Configuration is replicated from the primary CM to the standby CMs
- Information is exchanged using the same CM to Cisco WAE communication that occurs between every Cisco WAE and the CM.



Configurable Comprehensive Reporting

- Device Dashboard

Configurable list of reports to display on a device or device-group homepage

- Customizable, schedulable reports

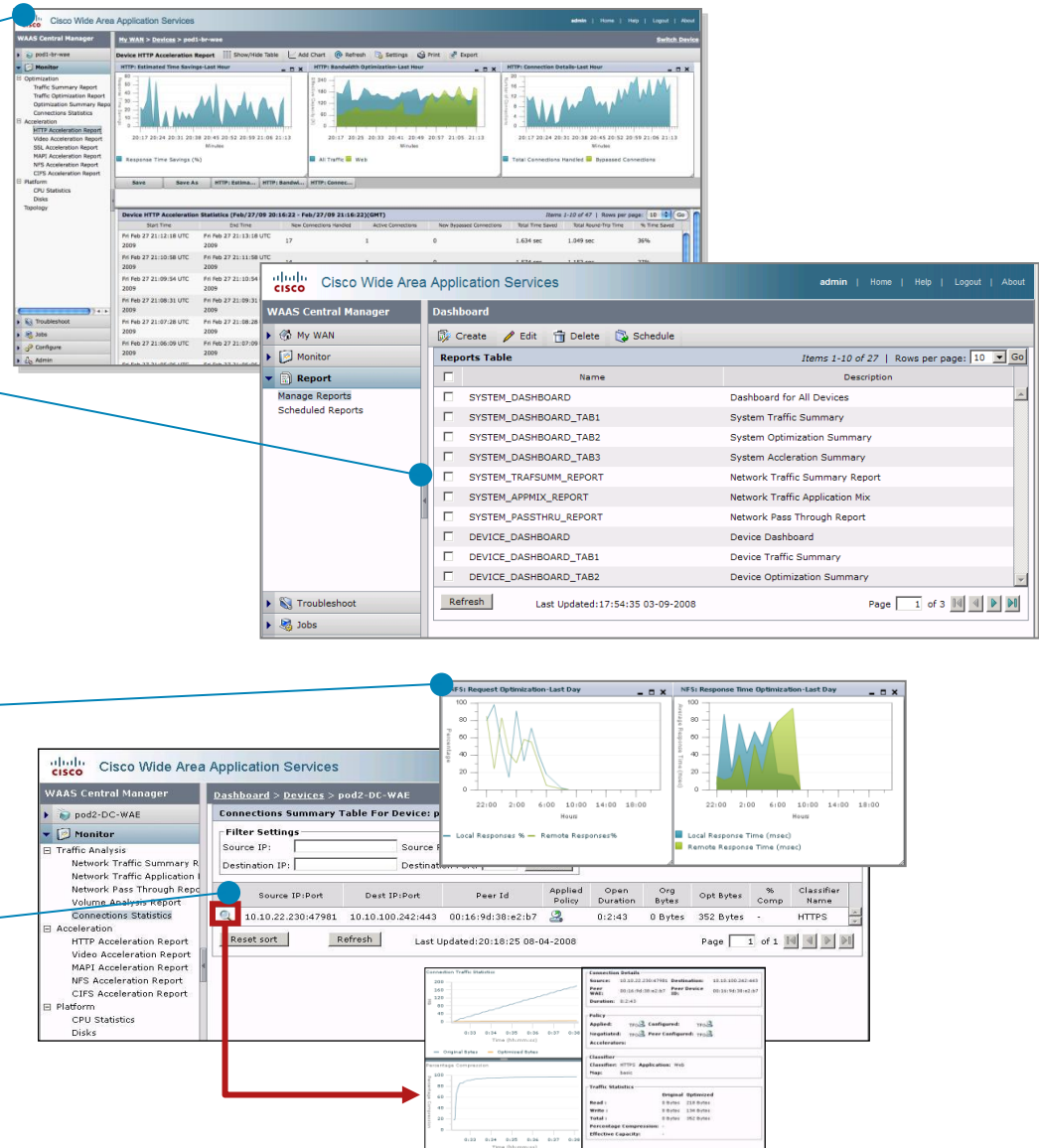
Device and system health, WAN optimization performance, application acceleration performance, and traffic statistics

- Traffic Statistics

Optimized vs pass-through traffic mix including pass-through reason

- Per-Connection Statistics

Connection monitoring shows near real-time view of optimized connections and details



Cisco Wide Area Engine (WAE)



The Cisco WAE Appliances and Service Modules are designed to address varying customer needs, from very small branch offices to massive data center deployments, and offer the highest single-device and clustered-device scalability in the industry

Cisco WAAS Router Modules



NME-WAE

**Router-Integrated Network Module
for the Cisco First Generation
Integrated Services Router**



SRE-SM

**Services Ready Engine (SRE)
Service Modules (SM)
for the Integrated Services Router G2**



**Cisco Integrated Services
Router (ISR) Series
2811, 2821, 2851, 3825, 3845**



**Cisco Integrated Services
Router G2 (ISR) Series
2911, 2921, 2951, 3925, 3945
3925E, 3945E**

**Reduce Branch
Footprint**

**Enhances IT
agility**

**Lowers Operational
Expenses**

WAAS Virtual Blades-Capable Branch Appliances



WAVE-274 Appliance



WAVE-474 Appliance



WAVE-574 Appliance



WAE-674 Appliance

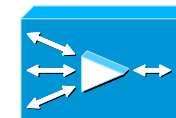
- Cisco Wide Area Virtualization Engine (WAVE) appliances extend the Cisco WAN optimization appliance portfolio to provide the industry's only branch-office appliance family that incorporates comprehensive WAN optimization, embedded virtualization for local hosting, and branch-office video delivery.






WAAS Express Platforms Supported

- ISR G2
 - 89x
 - 1941
 - 2901, 2911, 2921, and 2951
 - 3925 and 3945
- Interoperate with WAAS Data Center, Branch appliances, and modules running WAAS software 4.2+
 - Router Modules – NME-WAE and SM-SRE
 - WAAS appliances
 - WAVE appliances



Cisco WAAS Branch Platforms



	Hardware Configuration	Max Opt TCP Conn	Inline cards	Number of Virtual Blades	Drive (GB)	RAID	Memory (GB)	WAN Capacity (Mbps)
	NME-WAE-302	250	N/A	N/A	80	N/A	.5	4
	NME-WAE-502	400	N/A	N/A	120	N/A	1	4
	NME-WAE-522	800	N/A	N/A	160	N/A	2	8
	SM-SRE-700	500	N/A	N/A	500	N/A	4	20
	SM-SRE-900	1000	N/A	N/A	500	RAID-1	4	50
	WAVE-274	200	2-port	2	250	N/A	3	2
	WAVE-474	400	2-port	2	250	N/A	3	4
	WAVE-574-3GB	750	2-port/4-port	2	500	RAID-1	3	8
	WAVE-574-6GB	1,300	2-port/4-port	6	500	RAID-1	6	20
	WAE-674-4GB	2,000	4-port/8-port	2	600	RAID-5	4	45
	WAE-674-8GB	6,000	4-port/8-port	6	600	RAID-5	8	90

* Final recommendations requires a detailed sizing exercise that include application traffic mix, traffic characteristics, application load and other factors mentioned in the sizing guidelines.

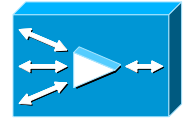
Cisco WAAS Express Sizing Recommendations



Platform	Total DRAM Required	Maximum WAN bandwidth Supported	Recommended Number of Users	Max TCP Connections
89x	768 M	2 Mbps	1-10	75
1941	2.5 G	4 Mbps	15-20	150
2901	2.5 G	6 Mbps	15-20	150
2911	2.5 G	6 Mbps	25	200
2921	2.5 G	6 Mbps	25	200
2951	4 G	6 Mbps	25	200
3925	4 G	10 Mbps	50	500
3945	4 G	10 Mbps	50	500

- WAAS Express requires maximum DRAM installed as indicated
- Typical Interfaces – 3G, T1, E1, Multi T1s, Multi E1s, and Serial
- Performance Testing Conducted with IOS FW, VPN (IPsec), NAT, and, QoS

Cisco WAE Family Data Center Platforms



Hardware Configuration	Max Opt TCP Conn	Inline cards	Drive (GB)	RAID	Fan-Out	Memory (GB)	WAN Capacity (Mbps)
WAE-674-8GB	6,000	4-port/8-port	600	RAID-5	200	8	90
WAE-7341	12,000	4-port/8-port	900	RAID-5	1400	8	310
WAE-7371	50,000	4-port/8-port	1500	RAID-5	2800	24	1000
Replicator Mode							
WAE-7341	2,500	4-port/8-port	900	RAID-5	4	8	310
WAE-7371	5,000	4-port/8-port	1500	RAID-5	9	24	1000



WAE-7341
Enterprise Data Center Appliance



WAE-7371
Enterprise Data Center Appliance



WAE-674
Enterprise Appliance

* Final recommendations requires a detailed sizing exercise that include application traffic mix, traffic characteristics, application load and other factors mentioned in the sizing guidelines.

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Why Cisco WAAS?

Differentiators

Proof Points

Benefits

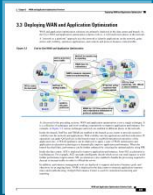
Router integrated Solution



- Broadest portfolio
- Software based & hardware integrated options
- “On-demand” services

- Enables IT service agility
- Reduces branch footprint
- Reduces deployment and maintenance costs

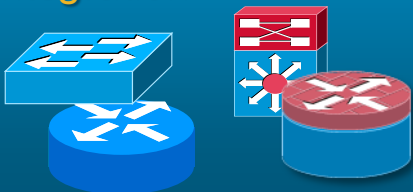
Proven end-to-end architectural approach



- Over 5000 customers
- Validated, tested design guides
- Award-winning Cisco global support & advanced services

- Eases deployment
- Ensures seamless network integration
- Help where and when you need it

Network services integration



- Network Transparency - Seamless integration with QoS, VoIP, and firewall services
- Fully preserves security policies
- Industry-leading application transparency

- Reduces deployment and management complexity
- Protects investments
- Speeds problem resolution

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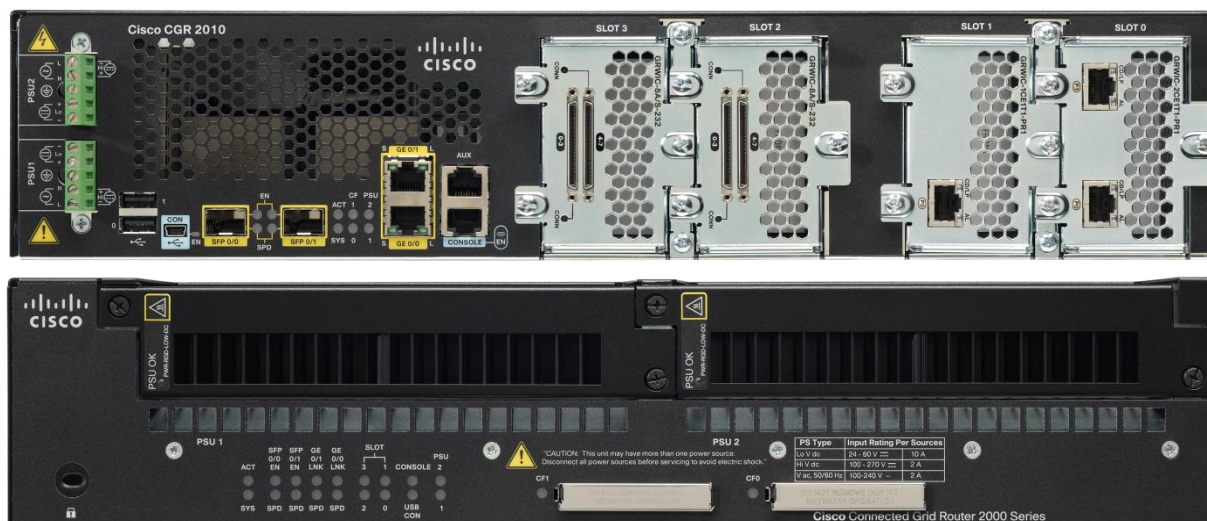
CISCO



Cisco Connected Grid Router & Switches Brief Overview

Substation Automation

Cisco CGR 2010 – Substation Router



Enhanced for Utility deployments

- Substation Compliant (IEC 61850-3, IEEE 1613)
- No Moving Parts
- Purpose built for Substation environments – industrial grade components
- Dual Redundant, Field Replaceable Power Supplies (Same P.S. as CGS 2520)
- Extended Temperature Range Support
- Extended Power Supply Support
- Choice of Front or Reverse Cabling
- IEEE 1588 HW Ready
- Advanced IOS Security - NERC/CIP capable
- SCADA Inspection – IPS, FPM
- SCADA Tunneling capabilities - BSTUN
- Hardware Based Security solution: SUDI

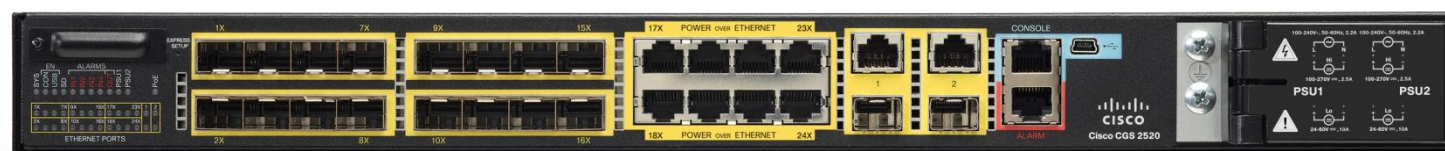
Substation Automation / Integration

Cisco CGS 2500 Series



CGS-2520-24TC

24 10/100 ports
2 dual-port GE uplinks



CGS-2520-16S-8PC

16 FE SFP ports
8 10/100/PoE ports
2 dual-port GE uplinks

Based on the Cisco Catalyst 2K / 3K series, the most successful Enterprise Switches in the world today!

Enhanced for Utility deployments

- Substation Compliant (IEC 61850-3, IEEE 1613)
- No Moving Parts
- Dual Redundant, Field Replaceable Power Supplies
- Extended Temperature Range Support
- Extended Power Supply Support
- Choice of Front or Reverse Cabling
- CG Swap Drive Functionality
- High availability platform: REP, Flexlink
- GOOSE support: QoS, Fast Ring Convergence and VLAN handling
- MODBUS Memory Map support
- Utility Specific Smartport macros.
- Hardware Based Security solution: SUDI
- Advanced Security solution
- Option to upgrade to Layer 3 feature sets



CISCO